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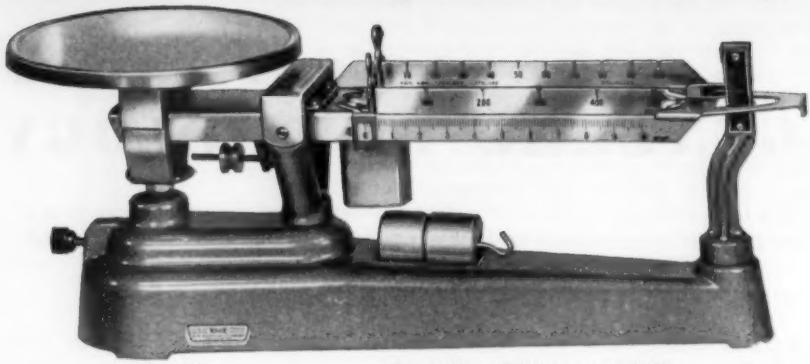

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THE American Pharmaceutical Association is the first organization of pharmacists in America to reach its centennial. Founded in Philadelphia in 1852 by twenty-four practitioners of pharmacy, it now has 16,000 active and 9000 associate members. The immediate reason for its formation was the need for concerted action to improve the quality of drugs required to compound the prescriptions of physicians. In the early days of the Republic, most drugs were imported from foreign sources. No uniformity in standards was observed at the various ports of entry. A shipment of opium or cinchona bark or senna leaves might fail to pass inspection at New York and then be taken to Philadelphia, Baltimore, or Boston and be admitted, because the inspectors at these points were guided by a lower standard.

It was to overcome such laxity in the admission of drugs, and also to promote more formal training for those entering the practice of pharmacy, that the first group of pharmacists met in New York in October 1851. At a second session, in Philadelphia, October 6–8, 1852, they founded a permanent national organization, which has been functioning in behalf of the profession ever since.

One of the first acts of the new association was to adopt a Code of Ethics to govern the professional practice of pharmacy. Agitation by the association for sound laws to prevent adulteration and misbranding of drugs and to create official standards resulted in the eventual passage of pharmacy laws in each state, as well as in the federal government.

Although several colleges of pharmacy were already in operation in 1852 the American Pharmaceutical Association provided the stimulus for the establishment of pharmacy courses in many other private institutions and in state universities. Today there are more than 70 accredited colleges of pharmacy and more than 100,000 registered pharmacists practicing their profession in 50,000 pharmacies and in several thousand hospitals, manufacturing plants, wholesale drug houses, public institutions, and government agencies.

As the association completes 100 years of progress, its objectives, as stated in its constitution, still include improvement in production and distribution of drugs and medicines; fostering and encouraging interprofessional relations in the interests of better health; improving the art and science of pharmacy through its journals, monographs, and *The National Formulary*; supporting programs of education to prepare personnel for the profession; promoting higher standards of licensure and registration for pharmacists, to ensure the availability of competent personnel; and conducting in its own laboratory, and through research grants, investigations and experiments for the improvement of the quality of drugs.

The American Pharmaceutical Association, as an affiliate of the AAAS, endeavors to bring to those who are interested in medicine the type of program that will orient them in a field that fascinates the uninitiated and frequently baffles those charged with the duty of bringing the latest contributions of science to the sick promptly and effectively and at a cost that does not make a cure prohibitive.

On October 7 the American Pharmaceutical Association observed its Founders' Day with a symposium on interprofessional ethics. Following a centennial dinner, the addresses of three speakers were transmitted to 10,000 members in the local and student branches of the association, which were holding simultaneous meetings in more than sixty cities from coast to coast. Underlying the Founders' Day program was the realization that modern science, with its mass production and distribution, is bound to exert a great influence on the social and economic welfare of the American people. This, in turn, will require redefining the lines of demarcation of the various professional functions in the field of medical care, and it may necessitate careful reconsideration of professional codes, especially in their interprofessional aspects.

ROBERT P. FISCHELIS
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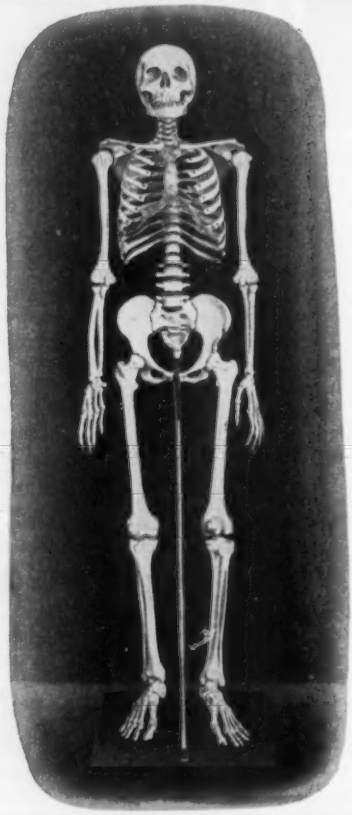

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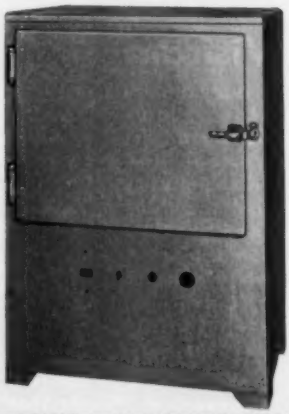

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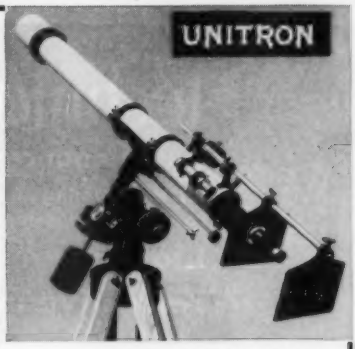

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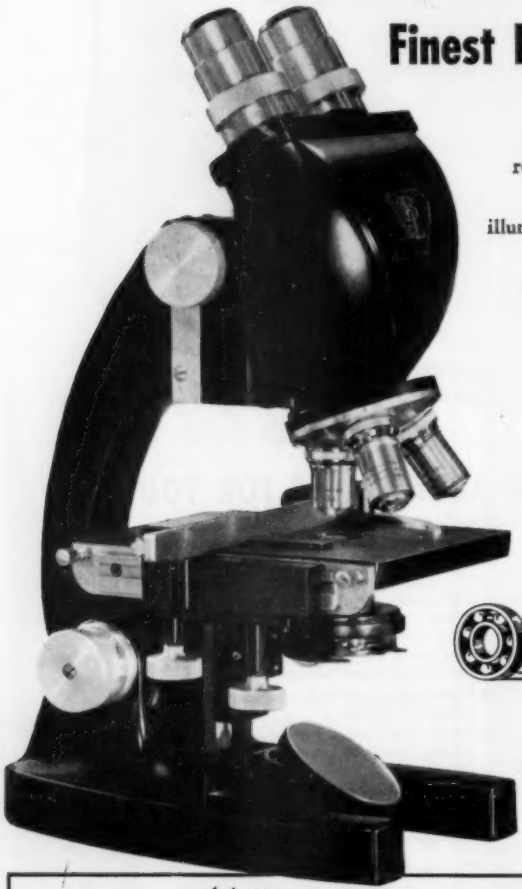

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Lamont Natural Radiocarbon Measurements, II[1]

J. Laurence Kulp, Lansing E. Tryon, Walter R. Eckelman, and William A. Snell[2]

Lamont Geological Observatory (Columbia University), Palisades, New York

THE INTEREST IN NATURAL RADIOCARBON MEASUREMENTS has been constantly increasing, particularly among those formally concerned with historical science. This is evidenced in part by the growing number of significant samples that are being submitted for analysis. As each paper containing radiocarbon measurements (*1–3*) is published, new fields of application have been demonstrated and confirmatory evidence for the validity of the age method has been amassed. Although a few anomalous results remain unresolved, the agreement among the different laboratories, the self-consistency of the data, and the correlation of the ages measured with external checks provided by geology and archaeology assure the general applicability of the method. The measurements that do not seem in accord with other information are the most interesting to the experimentalist in this field and are the subject of intensive study.

The measurements presented below were made between November 1, 1951, and August 1, 1952. The techniques used are described elsewhere (*4, 5*). An advance in technique (*5*) permits dating back to 30,000 years—an extension of 5000 years over the period determinable with the techniques available when the first list of dates from this laboratory (*3*) was published. The dates given are based on the half-life of carbon 14 of 5568 ± 30 years (*6*). The error listed in years is calculated from the standard deviation of the counting data. Actually this error is not symmetrical, but since it is only used as an index of precision the procedure is adequate.

Table 1 shows the results of some samples of archaeological interest. The 122 Series from Peru was chosen to compare the age of shell and organic material. Although at a few other localities (e.g., Libby's Annis Mound samples 116 and 251 [*1*]) there is substantial agreement in the ages derived from these two types of material, at this locality the shells give ages that are too old. The shell sample from the 123 Series shows the same anomaly. Several possible explanations come to mind. If shells were used as ornaments, they could be older shells that had been reworked on local

TABLE 1

ARCHAEOLOGICAL AND PALEONTOLOGICAL SAMPLES

Sample No.	Description	Age (yr)
L-126F*	Charcoal from hearth in Piney Creek alluvium NW¼NW¼ sec 25, T 25, R 68 W, Denver area, Colo. Estimated age, 500–1000 yr. Submitted by C. B. Hunt.	1150 ± 150
L-133A	Charcoal from prehistoric site at Oued Djebbana, south of Tebessa, Algeria. This locality is near the Aterian site of Bu-el-ater. The sample was believed to be of Aterian (i.e., pre-Capsian) age. Comment: evidently not pre-Capsian.	3700 ± 200
L-133B	Charcoal from the basal portion of the deposits at Dra-Mta-el Ma el-Abiod, which on typological grounds is assigned to the Upper Capsian culture. 133A and 133B submitted by L. Balout, University of Algiers.	7000 ± 200
L-134	Charcoal from large shell heap of El Mekta, near Gafsa in Southern Tunisia. This is a site of the Upper Capsian culture. The Capsian is estimated to be not older than 10,000 ± 1000 yr. Submitted by E. Gobert, Department of Antiquities of Tunisia.	8400 ± 400
L-135	Charcoal from the site of Metlaoui in Southern Tunisia. Locality also known as the Gisement or Abri des Jaatcha. Metlaoui is a very typical site of the so-called Neolithic of Capsian tradition, a widespread post-mesolithic development in North Africa. Estimated age: probably not older than 4500 ± 500 yr. Submitted by R. Vaufrey, Institut de Paleontologie Humaine.	5000 ± 150

[1] Lamont Geological Observatory Contribution No. 64.

[2] The research sponsored in this paper has been made possible through support and sponsorship of the Air Force Cambridge Research Center, the Office of Naval Research, the American Museum of Natural History, and the Higgins Fund of Columbia University. The cooperation of the U. S. Geological Survey is gratefully acknowledged. The Carbon 14 Cooperative Project Committee, consisting of W. D. Strong (*Chairman*), H. Shapiro, J. B. Bird, and W. H. Bucher, gave valuable counsel on sample procurement, priority, and evaluation. The cooperation of E. Ingerson, C. B. Hunt, and Troy L. Péwé, of the U. S. Geological Survey, was most helpful. H. L. Movius, Jr., procured several valuable North African samples. J. B. Bird kindly supplied sample descriptions and interpretation for several archaeological specimens. The excellent laboratory assistance of B. Eckelmann and B. Tryon is appreciated.

TABLE 1—(*Continued*)

Sample No.	Description	Age (yr)
L-126C	Wood from fallen roof of cist inside early Pueblo rock shelter. The locality is on the W side of the Colorado River, about 2 mi above the Moab Bridge. The cist is about 50′ above the river and 150′ S of the witness corner for the quarter corner between sec 25 and 26, T 25 S, R 21 E. Dated with pottery as Pueblo II–III, i.e., 1050–650 yr ago. Submitted by C. B. Hunt.	950 ± 150
L-129	Stomach contents of large moa (*Dinornis*), Pyramid Valley Swamp, North Canterbury, New Zealand. Approx 5′ below present surface. Submitted by H. Shapiro.	1800 ± 150
L-130A	Pine cones from a thermal spring at Ciego Montero, Cuba, associated with extinct mammal forms including Edentes turtles, sloths, and rodents. Pine trees now unknown in this part of Cuba but may have been present at last Wisconsin maximum. Submitted by Ernest Williams via E. H. Colbert.	Older than 30,000
L-130B	Wood from same spring as 130A but suspected younger.	25,000 ± 2000
122 Series	Guañape Culture materials from Strata Cut 1 at Site V-71, Huaca Negra, Virú Valley, Peru. In the cultural stratigraphy of Strata Cut 1, the levels from the surface of the site to a depth of 1.75 m have been shown to be Middle Guañape, more commonly known as the Cupisnique or Coastal Chavin culture; those from 1.75 to 4.0 m, Early Guañape, the first period in which ceramics were utilized in this section of Peru. As the arbitrary excavation levels did not coincide with the strata, some preceramic debris was included with the material removed above the 4-m level; hence, the age of 122G may apply to the upper portion of the preceramic horizon. Because of the thickness of the Early Guañape deposit and the sufficiency of materials therefrom, an arbitrary split, roughly in the middle, has been made in the Early Guañape materials at 2.75 m below the surface. In the Middle Guañape samples, no materials from the surface to a depth of 0.25 m have been included in order to prevent possible surface contamination. Collected and submitted by W. D. Strong.	
L-122A	Charcoal from 0.25–1.75 m (Middle Guañape).	3050 ± 200 3200 ± 100 Av 3150 ± 90
L-122B	Shell from 0.25–1.75 m (Middle Guañape).	5650 ± 200 6000 ± 400 Av 5750 ± 180
L-122C	Charcoal from 1.75–225 m (Upper Early Guañape).	3100 ± 200
L-122D	Shell from 1.75–2.25 m (Upper Early Guañape).	4300 ± 200
L-122F	Charcoal from 2.75–4.0 m (Lower Early Guañape).	3800 ± 150
L-122G	Shell from 2.75–4.0 m.	5300 ± 200
	Comment: The charcoal dates fit the calendar for the region established by other C^{14} dates (*1, 2*) and are self-consistent.	
123 Series	Samples taken from midden formed against Temple of the Sun, Pachacamac, Peru, excavated by W. D. Strong in 1941. The material is associated solely with Inca and Inca-contemporary pottery types, and must date from the period of Inca control. Known age, 444 ± 25 yr. (Personal communication from John Rowe via J. B. Bird.)	
L-123A	Marine shells, mainly *Concholepa*, with some *Mytilus*.	3800 ± 200
L-123B	Rope and matting, largely sedge and cattail.	800 ± 100 900 ± 150
L-123C	Mammalian remains. Fur and llama skin.	450 ± 150 500 ± 120

* In order to avoid future ambiguity in cross references, it has been agreed among the carbon 14 laboratories to prefix their sample numbers with a letter indicating which institution is involved. Thus C = Chicago, L = Lamont, M = Michigan, Y = Yale, etc.

beaches. That this hypothesis is unsatisfactory in the Virú Valley and at Pachacamac was pointed out by J. B. Bird, because it seems certain that the animals in these shells were used for food. In fact, some shells were stained with an organic dye secreted by the living organism when dislodged from its habitat. Another explanation might be that ancient carbon from a fresh or brackish water environment was utilized by the organism, but this does not apply here because the shells selected were all marine species. Carbonate exchange with ancient carbon in ground water derived from limestone strata is also a possibility, but can be ruled out in this case because the samples were found in dry deposits.

Several other factors must be considered before a satisfactory hypothesis can be constructed: (1) The same anomaly occurs off the Aleutian coast (Table 2-C, Samples L-112 D, E, and F), the California coast (Table 2-C, Sample L-144 D), and from one deposit in Japan (E. S. Deevey, personal communication). (2) Modern shells on the Atlantic and Gulf coasts

seem to give proper values, although there are only a few measurements. (3) Deep ocean water seems to circulate very slowly (Table 3) and may have the radiocarbon content reduced by an age equivalent of several thousand years.

TABLE 2
GEOLOGICAL SAMPLES

Sample No.	Description	Age (yr)
	A. Bermuda	
	(The samples in this set are listed in stratigraphic order)	
L-120G	Sample of Southampton eolianite from Sayles (7) locality 4, taken 3′–4′ from top of 12′ thickness of formation.	17,600 ± 800
L-120F	Sample of top of Somerset from Sayles (7) locality 6.	21,000 ± 1600 21,300 ± 1600
L-120C	Sample near base of Somerset from Sayles (7) locality 2.	Older than 25,000
L-120B	Signal Hill soil sample from Sayles (7) locality 1. Comment: Unconsolidated and near surface, yet no contamination by meteoric CO_2.	Older than 25,000
L-120A	Pembroke eolianite from Sayles (7) locality 1. Same comment as for L-120B.	Older than 25,000
	B. Mississippi Delta	
	(These three 125 Series samples were taken from cores obtained by the Mississippi River Commission along a line between Donaldsville and Franklin, La. Submitted by H. N. Fisk)	
L-125A	Wood from depth of 25′.	2900 ± 300
L-125G	Shell from depth of 73′.	8700 ± 200 9000 ± 200
L-125I	Wood from 273′ on weathered surface, presumably produced during last great sea level lowering of the Wisconsin.	Older than 30,000
	C. General Geology	
L-140A	Fossil *Aeropora omisornis* from small patch reef near Fresh Creek village (on shore east of Commissioner's residence), Andros Island, Bahamas. This rock outcrops 4′ above high tide. Collected by J. K. Rigby; submitted by N. D. Newell.	Older than 25,000
L-140B	Loose drifting oolites 25° 15′ N, 79° 0′ W Great Bahama Bank. Depth, 3 fathoms. Collected by H. S. Smith; submitted by N. D. Newell.	2750 ± 150
L-144A	Shell (*Schizothaerus nuttallii*), W side of Mesa St., 100′ S of 3rd St., San Pedro, Calif., alt, about 75′. Palos Verdes sand (marine deposits on lowest terrace) assigned to late Pleistocene. Collected by W. P. Woodring.	Older than 30,000
L-144D	Recent shells, low tide, June 28, 1952, from Portuguese Bend on S (open sea) side of Palos Verdes Hills, Los Angeles Co., Calif. Collected by M. N. Bramlette.	1500 ± 200

TABLE 2—(*Continued*)

Sample No.	Description	Age (yr)
L-141A	Black mucky peat containing some *Helisoma* sp., a freshwater gastropod, from 0.0′–0.5′ above bedrock, 5.5′–6.0′ below land surface. Everglades Experiment Station, 2½ mi SE of Belle Glade on South (pasture) line, Station 8 + 00.	4900 ± 200
L-141B	Dark-brown fibrous peat (same description as for 141A except North [crop] line, Station 8 + 00). 141A and 141B, collected by J. C. Stephens; submitted by N. D. Hoy.	3800 ± 200
L-141C	Peat taken 0.0′–0.5′ above Fort Thompson marl, 5.0′–5.5′ below surface in 5.5′ peat section. Collected 10 mi S of Lake Okeechobee, 100′ W of U. S. Highway 27, located in NE¼SW¼ sec 25, T 45 S, R 36 E, Palm Beach Co., Fla. Submitted by N. D. Hoy.	5050 ± 200
L-138	Charcoal from Fall River formation (Dakota) in road cut just north of Bear Butte Lake, about 1½ mi SW of Bear Butte, 5 mi NE of Sturgis, S. D. Submitted by P. M. Wright, Wheaton College Science Station.	Older than 30,000
L-109	Fossil wood from laminated band of clay and organic matter about 125′ below surface of a canyon in valley fill in western Canadian Co., Okla., in sec 5, T 11 N, R 10 W. Submitted by R. Dreyer.	9000 ± 300
L-126A	Aragonite from West Reno well, Steamboat Springs, Nev. Comment: Carbon apparently derived from limestone, as expected. Less than 2% recent meteoric carbon. Submitted by D. E. White.	Older than 30,000
L-118	Fresh wood from tree stump 3′–4′ below mean high tide level, near Sagadahoc Bay, Maine. Represents epoch of lowered sea level. Submitted by W. H. Bradley.	4150 ± 200
L-150C	Lignite from Rapa Island, Austral group, Polynesia, Central South Pacific. Sample taken from lump of lignite coal 4″ thick. Collected by 1934 Mangareva Expedition, Bishop Museum No. 1409. Submitted by J. M. Schopf and H. Ladd. Comment: Geologists suspected it would be older than 30,000 years.	Older than 30,000
	D. Alaska	
L-127	Fragments of skin and dried tissue of extinct superbison collected from frozen muck on Dome Creek near Fairbanks. Comment: Suggests	Older than 28,000

TABLE 2—(*Continued*)

Sample No.	Description	Age (yr)
	permafrost continuous from beginning of second (last) major phase of Wisconsin in this region. Submitted by O. W. Geist, University of Alaska.	
L-117B*	Spruce root 4.5′ below surface of alluvial fan exposed in section 18.5′ long above mean high water on N side of Kachemak Bay, 50 yards W of Miller's Landing, Homer. The spruce root was deposited toward the end of the depositing phase of one of the numerous extensive alluvial fans that spread over Homer Bench from the 1000′ high Homer Bluff. Collected by W. S. Benninghoff, 1950.	3200 ± 150
L-117C	Wood 10′ beneath the surface in interbedded peat and muck at Coffee Creek, a tributary of Kougarok River, Seward Peninsula. The deposit was formed at a time when the climate was warmer than at present and is underlain by undated silt deposited at a time when the climate probably was colder than at present. Collected by R. S. Sigafoos.	8350 ± 200
L-117D	Wood and peat 3′ beneath surface in a peat layer interbedded with muck at head of Coffee Creek. Deposit indicates that accumulation of mucklike material has taken place during last few hundred years. The peat layer was formed at a time when the climate was not perceptibly different from the present. Collected by R. S. Sigafoos.	450 ± 100
L-117G	Wood 6′ beneath the surface in muck at Wilbur Creek near Livengood. The deposit was formed at a time when the climate was slightly warmer than at present. (Geologic estimate of age was 3000–6000 yr for 117G and 117H.) Collected by T. L. Péwé, 1951.	4200 ± 200
L-117H	Wood 6′ beneath the surface in an organic layer at Eva Creek, 10 mi W of Fairbanks. The deposit was formed at a time when the climate was slightly warmer than at present. Collected by T. L. Péwé, 1951.	3750 ± 200
L-117I	Wood from fossil beaver dam in muck at Fairbanks Creek, 20 miles NE of Fairbanks. Deposit formed when climate was slightly warmer than at present. (Libby reported 12,600 ± 750 yr for his Sample 301 from similar locality.) Collected by T. L. Péwé, 1951.	13,600 ± 600

TABLE 2—(*Continued*)

Sample No.	Description	Age (yr)
L-117K	Wood from end moraine within 1000′ of the present front of Tustumena Glacier, Kenai Peninsula. Deposit represents one of the most recent glacial advances in the Cook Inlet area, following a warmer period during which Tustumena Glacier was much less extensive than at present. Collected by T. N. V. Karlstrom, 1951.	400 ± 150
L-117L	Lignitized log from basal part of 8′ thick lake silt section overlying outwash, near East Foreland, Kenai Peninsula. Lake deposition began before the latest major glaciation in the Cook Inlet area. Assuming that the log analyzed was not derived from a previous deposit, the outwash underlying the lake silts is correlative with a pre-Mankato glaciation of more than 18,000 years ago. Collected by T. N. V. Karlstrom, 1951.	19,200 ± 1000
L-117N	Spruce log near base of 5′ peat section overlying lake silts deposited on till, near Boulder Point, Kenai Peninsula. Dating of the basal peat permits evaluation of rate of accumulation during the past 4000 yr in the Cook Inlet area. Collected by T. N. V. Karlstrom, 1951.	3800 ± 400
L-106B	Wood from bottom of muskeg in outwash, or possibly lateral moraine, of nearby Lemon Glacier. Submitted by Maynard Miller.	3500 ± 250
L-112D	Modern shells to be used as a control on 112E.	1950 ± 250 1650 ± 400 Av 1900 ± 300
L-112E	Clamshells from Aleut midden on north part of sand pit enclosing Clam Lagoon. (Note: If this is corrected by using the result of 112D, the apparent age is 2700 ± 150 yr.)	4620 ± 100 4610 ± 160 4530 ± 150 Av 4580 ± 90
L-112F	Buried peat horizon in section of north spit on east shore of Clam Lagoon. Oldest Aleut artifacts found on surface equivalent to, or perhaps slightly younger than, peat accumulation. This is stratigraphically older than 112E.	3300 ± 200
L-112H	Drift wood embedded in storm beach at Earle Cave. Latest shift of base level here must be younger than age of driftwood log.	650 ± 150
L-117A	Wood from buried peat overlying glacial outwash deposits	19,100 ± 900

TABLE 2—(*Continued*)

Sample No.	Description	Age (yr)
	and underlying till, near Goose Bay, north shore, Knik Arm.	
	E. Miscellaneous Samples	
L-126E	Uranium ore (carbonized wood) from the Triassic Shinarump formation at the Oyler Mine, Fruita, Utah. Comment: Chemical purification procedure is apparently adequate. Submitted by C. B. Hunt.	Older than 30,000
L-45	Country air, Lamont Observatory, July 18–25, 1951.	(Net cpm) 6.32 ± 0.20
L-46	City air, Amsterdam Ave. and 117th St., New York, Aug. 10–20, 1951.	5.92 ± 0.15
L-48	Laboratory air, Lamont Observatory, May 9–11, 1951.	4.67 ± 0.10
Standard	Modern wood.	6.07 ± 0.05

* Descriptions of 117 Series supplied by T. L. Péwé, U. S. Geological Survey.

An attractive hypothesis, therefore, might be that, in areas where the deep water moves up along a coast, the surface water would have a lower radiocarbon content. Despite the paucity of data, it appears that the lower radiocarbon content of the shells on some coastlines can be correlated with abrupt, deep troughs offshore—e.g., Japan, California, Aleutian arc, and Peru. Direct measurements on the radiocarbon content of the ocean carbonate taken from many locations and depths are being made.

Another problem arises in connection with the 123 Series. It is noted that only the mammalian remains give the correct age. Although wood appears generally above suspicion, it has been suggested by E. S. Deevey that plants which derive their carbon in part from fresh-water lakes rather than directly from the air may show erroneously old ages. It is at least interesting that sedge and cattail are botanical types that presumably fall into this suspect group. Studies on the radiocarbon content of such plants, as well as of fresh lake water, are being undertaken by the Yale laboratory.

A list of the results on samples of geological interest is given in Table 2. The Bermuda samples show that (*a*) the ages are in correct sequence, (*b*) meteoric water does not contaminate loose limestone even when it occurs at the surface, and (*c*) the upper layers are sufficiently young so that a detailed analysis with more samples might shed considerable light on the worldwide climatic fluctuations during the last half of the Wisconsin glacial period. The samples from the Mississippi Delta show the progressive rise in sea level after the Wisconsin maximum. It is particularly significant that L-125G gives approximately the same age as the drowned forest on Greater Bermuda (*3*), which is now 60′–90′ below sea level. Any exchange with meteoric water prior to burial would have increased rather than decreased the age.

Florida peat samples in the General Geology section demonstrate that peat formation began over this wide area about 6000 years ago.

The anomalous values for some modern shells have been referred to above. In the samples from Clam Lagoon (112D, E, and F), however, both modern and ancient shells are available. If 112E is corrected by using the modern shell count *on the same coast*, the age is then consistent with the stratigraphic relationships. It appears that more study will be required before the exact conditions are known under which quantitative ages from shell may be ascertained. The present data suggest that exchange is relatively unimportant; therefore, if the original radiocarbon content for a given location is known, a reliable age determination may be made.

L-126E was run to give the chemical purification system the most severe test. It is evident that contamination of the sample by uranium-thorium series elements is negligible.

TABLE 3

Sample No.	Description	Age (yr)
	A. Ocean Samples	
L-121A	Core C-10-5, 22–32 cm, 33° 37.4′N 62°29.6′W. Depth of water, 2670 m.	20,600 ± 900 20,400 ± 900
L-121B	Core C-10-5, 70–80 cm.	28,000 ± 2000
L-121C	Core A-152-118, 0–5 cm. North Atlantic W of Mid-Atlantic Ridge, 35°07′N 44°40′W. Depth 4334 m.	5,000 ± 200
L-131A	Core A-172-2, 29–35 cm. Water depth, 3070 m. Caribbean, on E flank of Beata Ridge, 16°12′N 72°19′W. Sample taken at base of *Globorotalia menardii* zone.	14,250 ± 500
L-131B	Core A-172-2, 220–227 cm. Caribbean, top of *Globorotalia menardii* var. *flexuosa* zone.	Older than 30,000
L-153	Core A-164-14, 75–88 ½ cm, 36°06′30″N 67°19′W. Depth, 4810 m.	Older than 27,000
	B. Deep Ocean Water[*]	
54°35′N 41°W	Surface	(1) 6.82 ± 0.09 (2) 7.74 ± 0.07 Av 6.77 ± 0.06 — Recent
	Av, modern shells	6.72 ± 0.10
58°19′N 32°56.8′W	1829 m	5.38 ± 0.07 5.60 ± 0.11 Av 5.45 ± 0.06 — 1600 ± 130
53°52.6′N 21°06′W	2743 m	5.31 ± 0.12 5.36 ± 0.12 Av 5.34 ± 0.10 — 1750 ± 150

* Direct comparison: Difference in cpm of surface sample *vs* 58° 19′ N was, from averages, 1.32 ± 0.10; from direct measurement, 1.15 ± 0.12.

Table 3 gives additional measurements of some deep-sea core samples and ocean carbonate. Samples from Cores C-10-5 and A-152-118 were previously measured (*3*). Core A-172-2 shows the normal, slow depositional rate. From lithologic evidence, it was suspected that this depth may have been quite recent. The fact that it is not emphasizes the complex character of these sediments. Not only are they frequently redistributed, but lithologically and paleontologically similar sections may be unrelated on the short time span over which radiocarbon dating can be applied.

The deep-ocean-water results will be described in more detail elsewhere (*8*). It seems from the meager data that deep water has measurably less radiocarbon than surface water and that the rate of turnover of the ocean must take place on a scale of thousands of years.

Table 4 shows the count rate as related to carbon sample weight. It is now possible to measure as little as 0.5 g of carbon instead of the usual 8.0 g. The precision is lower, however, and considerably more effort is required.

TABLE 4

COUNT RATE AS A FUNCTION OF SAMPLE SIZE FOR MODERN WOOD

Wt of carbon (g)	Net cpm	No. of samples
10.00	6.10 ± 0.08	1
8.00	6.07 ± 0.05	7
6.00	5.88 ± 0.09	2
4.00	5.71 ± 0.08	1
1.85	4.10 ± 0.10	2
0.95	3.07 ± 0.07	2
0.79	2.80 ± 0.09	1
0.63	2.40 ± 0.06	1

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News and Notes

Scientists in the News

Norman H. Beamer, of the USGS, has been designated district chemist in charge of quality-of-water investigations in Pennsylvania, with headquarters at Philadelphia. He has been acting district chemist since July 1951, when he replaced **Walter F. White, Jr.** Mr. Beamer has been assigned to the Pennsylvania investigations since 1946.

Herbert Blumer is now chairman of the Department of Sociology and Social Institutions on the Berkeley campus of the University of California. He had been a member of the University of Chicago faculty since 1928. He is the first vice president-elect of the American Sociological Society. For 11 years, from 1941 to 1952, he was editor of the *American Journal of Sociology*.

Henry B. Bull, formerly professor of chemistry in the Medical School at Northwestern University, is now professor and head of the Department of Biochemistry at the State University of Iowa.

Homer D. Chapman, chairman of the Department of Soils and Plant Nutrition at the University of California Citrus Experiment Station, will address horticultural scientists at the 13th International Horticultural Congress in London. After the conferences in London, Dr. Chapman will visit all the important citrus-producing areas of the Mediterranean region to study soils and plant nutritional relationships. He will return to California by way of the citrus-growing areas of Pakistan, India, and Japan. During his leave of absence, extending until Jan. 15, **Daniel G. Aldrich, Jr.,** will serve as acting chairman of the department.

John Chipman, head, MIT Department of Metallurgy, is the 1952 recipient of Sauveur Achievement Award, presented by the American Society for Metals. The award was established by ASM in 1934 in honor of Albert Sauveur, late Harvard University professor, to recognize pioneering metallurgical achievements. Dr. Chipman has also been chosen by the Italian Metallurgical Society as the winner of the 1952 Losana Gold Medal for making the greatest contribution to international research and cooperation in the field of metallurgical engineering.

Alfred L. Copley, formerly of New York Medical College and New York University, has been appointed chargé de recherches de laboratoire at the new research laboratories of the Centre International de l'Enfance, Paris, a United Nations organization. Dr. Copley recently completed, at Woods Hole Marine Biological Laboratory, projects on bleeding and clotting, which he directed for the Atomic Energy Commission and the Office of Naval Research. He will continue his researches on blood and blood vessels in Paris.

Walton H. Durum has been transferred from Lin-

coln, Nebr., to Washington, D. C., and designated acting chief, Technical Reports Section, Quality of Water Branch, Water Resources Division, USGS. He will advise the chief of the branch on matters relating to technical reports and the relationship of those reports to the investigational work of the branch and the division.

Geoffrey Edsall, director of the Army Medical Service Graduate School's Immunology Division, is completing a trip to Europe and the Near East as a representative of the Armed Forces Epidemiological Board. He is visiting England, France, Italy, Egypt, Greece, Cyprus, and Israel, consulting with military and public health officials on typhoid immunization.

Maxwell Gage, senior lecturer in geology, Canterbury University College, Christchurch, New Zealand, a constituent college of the University of New Zealand, is visiting assistant professor of geology at the University of Illinois for the academic year 1952–53. Dr. Gage will teach courses in structural geology and allied subjects.

T. Gold, of the Cavendish Laboratory, Cambridge, has been appointed a chief assistant at the Royal Greenwich Observatory, England. Dr. Gold has recently been concerned with magnetohydrodynamics and the problem of the polarization of starlight. He was the first to suggest that point sources of radio noise (the so-called radio stars) may be of extragalactic origin and identifiable with galaxies of which the spectra indicate highly turbulent motion.

Assignments to three of four new positions in the Bureau of State Services, Public Health Service, include **Mark D. Hollis,** chief sanitary engineering officer, who has been named deputy bureau chief; **Jack C. Haldeman,** formerly chief of the service's Division of State Grants, who has been assigned, assistant bureau chief for Regional Office and External Operations; and **Joseph O. Dean,** formerly associate bureau chief for Staff and Management Services, who has been transferred to the newly created post of associate chief for program development.

T. C. Keeling, Jr., has been appointed deputy director of the chemical division of the National Production Authority. Mr. Keeling, who is assistant vice president and chemical division sales manager of the Koppers Company, Pittsburgh, is being lent to the government for a six-month term.

The New York Academy of Medicine has appointed **Harry D. Kruse** secretary to the Committee on Public Health Relations of the academy. Dr. Kruse succeeds **E. H. L. Corwin,** who retired. Dr. Kruse has been on the staff of the Milbank Memorial Fund since 1937.

G. Kenneth Lewis, the first faculty member of the University of Illinois Chicago Professional Colleges to be recalled to military duty during the Korean war, has been discharged and has returned to Chicago. Dr. Lewis, clinical assistant professor of otolaryngology in the College of Medicine, was recalled to active duty as a colonel in the U. S. Army Medical Corps in 1950. At the time of his recall, he was commanding officer of the 374th Convalescent Center, a 3000-bed hospital unit. During most of his 24 months of service, he has been chief of surgery at Fort Campbell, Ky.

Martin E. McGreal, professor of chemistry at St. John's University, has been named head of the department, succeeding **Edward V. O'Brien.** The latter has been transferred to Baltimore as rector of the Roman Catholic Church of Our Lady of Lourdes. Dr. McGreal joined the faculty of St. John's in 1933, after a ten-year period as teacher of chemistry at New York University and the University of Pittsburgh.

Hans Neurath, professor of biochemistry, University of Washington, has returned from a trip to England and Denmark, where he participated in the discussions of the Faraday Society on the physical chemistry of proteins, held in Cambridge. In Copenhagen, he lectured at the Nordisk Insulin Laboratory and at the Carlsberg Laboratory, on insulin and proteolytic enzymes.

James K. Palmer, biochemist, has been appointed to the staff of the Connecticut Agricultural Experiment Station, and **Jerry S. Olson** has joined the staff of the Forestry Department. Dr. Palmer replaces **A. N. Meiss,** and Dr. Olson fills the post formerly held by **John Krier.**

David Pomeroy, formerly of the Department of Physics at the University of Florida, has joined the staff of the Biophysics Department at the Army Medical Research Laboratory, Fort Knox, Ky.

W. Malcolm Reid, who has been studying the effects of animal parasites upon the poultry industry as a Fulbright research scholar in Egypt, has joined the Technical Cooperation Administration (Point IV) staff of the American Embassy in Cairo. His new position is that of research adviser in animal hygiene. His leave of absence from Monmouth College has been extended for one year.

Robert W. Schiessler, associate professor of chemistry at Pennsylvania State College, has been chosen for the $1000 American Chemical Society award in petroleum chemistry. It will be presented at the meetings of the society in Los Angeles in the spring of 1953. The award is underwritten by the Precision Scientific Company.

Thomas Segundo, Papago tribal leader, has been selected as the recipient of the 1952 Indian Achievement Award, a bronze medal presented annually to an Indian by the Indian Council Fire. Mr. Segundo is chairman of the Papago Tribal Council, and has done much to advance the interest and welfare of his people, sacrificing his ambition for an engineering education to serve them.

Education

In celebration of the 25th anniversary of its medical center, the **University of Chicago** conferred an honorary D.Sc. degree on Anton J. Carlson, president of the AAAS in 1944; he was cited as "an inspiring and stimulating teacher and a critical investigator." Another Chicago alumnus, Percival Bailey, of the University of Illinois, was among the seven scientists who received honorary degrees. The anniversary program began with the Dallas P. Phemister Memorial Lectures, given by Evarts A. Graham and Alfred Blalock. Twenty-six alumni of the medical school were awarded Distinguished Service Certificates during the three-day meeting.

Educational Testing Service has announced the formation of an Evaluation and Advisory Service for school and college test users. Paul Diederich will become director of the new unit, and Anna Dragositz assistant director. The service will be particularly concerned with the use of tests to evaluate results of school and college educational programs. For full information, address the director of the service at 20 Nassau St., Princeton, N. J. Western institutions should direct their inquiries to 4641 Hollywood Blvd., Los Angeles 27.

Florida State University has appointed John J. Spitzer, of Dalhousie University, assistant professor in physiology. A. C. Higginbotham, associate professor of physiology, has returned to the university after a leave of absence at St. Louis University School of Medicine.

The program of the **New York Academy of Medicine** Lectures to the Laity, beginning on Oct. 22, will feature the following speakers: Franz G. Alexander, John A. Rose (Nov. 5), Otis R. Rice (Nov. 19), W. Horsley Gantt (Dec. 3), William Malamud (Jan. 7), and P. Le Corbeiller (Jan. 28).

A **Pediatrics Conference** will be held in Galveston Nov. 17–21, under the auspices of the Postgraduate Division of the University of Texas Medical Branch, the Department of Pediatrics, the University of Texas Child Health Program, the Texas Medical Association, the State Department of Health, the Texas Academy of General Practice, and the University of Texas Postgraduate School of Medicine. Guest speakers will include Douglas M. Buchanan, Donald E. Cassels, J. Louzoya (Mexico City), Edward L. Pratt, and Lawson Wilkins.

The Department of Physics of the **University of Texas** has added the following to its faculty: Joseph C. Grosskreutz, of California Research Corporation; Eugene Ivash; and Walter Millett.

The **University of Washington** has appointed Richard B. Goldschmidt, of the University of California, as Walker-Ames professor of zoology and Ernst Mayr, of the American Museum of Natural History, visiting professor of zoology. During the autumn quarter, Dr. Mayr will conduct a graduate course on systematics and evolution, and Dr. Goldschmidt will deliver a series of lectures on "Glimpses of the Advancing Front of Genetics."

The **University of Wisconsin** has named Frank MacFarlane Burnet, director of the Walter and Eliza Hall Institute for Medical Research and professor of experimental medicine at the University of Melbourne, to the Knapp visiting professorship. He will present a course of six lectures on "Problems in the Biology of Infectious Diseases."

Grants and Fellowships

The **Committee on Growth** of the National Research Council, acting for the American Cancer Society, is accepting applications for fellowships and for grants for Scholars in Cancer Research. Applications for postdoctoral fellowships for training and research in all branches of biological, chemical, and physical sciences and of investigative medicine applicable to the study of growth, must be received by *Dec. 10*, for work to begin July 1. Applications for grants should be submitted by an institution on behalf of a candidate prior to *Jan. 1*. With these awards a grant of $6000 a year for three years is paid to the institution. Three British-American Exchange Fellowships are also available, through the cooperation of the British Empire Cancer Campaign Fund. In this program the committee will favor a proposed training program in specialized scientific areas in which superior facilities exist in Great Britain. For full information address the executive secretary of the committee, 2101 Constitution Ave., N.W., Washington 25, D. C.

The Board on Overseas Training and Research of the **Ford Foundation** has announced awards aggregating $473,850, for periods of from one to three years, to enable 83 American college graduates to initiate or continue studies on various problems concerning Asia and the Near and Middle East. The recipients, 75 men and 8 women, were selected from more than 700 qualified applicants and range in age from 21 to 43. No decision has been reached with respect to continuing the program a second year.

The **National Foundation for Infantile Paralysis** has available a limited number of postdoctoral fellowships for candidates whose interests are research and teaching in medicine and the related biological and physical sciences. Fellowships cover a period of one to five years, and stipends range from $3600 to $7000 a year. Institutions accepting fellows receive additional compensation. Eligibility requirements include U. S. citizenship, or declared intention of becoming a citizen, sound health, and an M.D., Ph.D., or equivalent degree. Complete information may be obtained from the foundation's Division of Professional Education, 120 Broadway, New York 5.

United Cerebral Palsy has made grants totaling $109,695 for research and training extending from

Oct. 1 to May 1. Seven grants for new research ($23,350) were made in addition to $66,922 for renewals. Children's Medical Center, Boston, will receive $15,000 for the training of personnel, and the Children's Rehabilitation Institute, Cockeysville, Md., $15,000 for the same purpose.

In the Laboratories

Allied Chemical & Dye Corporation is starting a million-dollar expansion of its Nitrogen Division research and engineering facilities at Hopewell, Va. The new buildings will have an area of 35,000 square feet of floor space and will make additional space available for the work of the Ammonia Department.

Chemstrand Corporation has appointed Bruno R. Roberts research scientist in the Research and Development Department. Dr. Roberts was with Monsanto Chemical Company for nine years, and recently has been engaged in fiber research at Chemstrand's Dayton laboratories. Other new appointments in the department include David B. Capps, Maynard E. Hall, James E. Johnson, and Brewster B. Eskridge.

Consolidated Engineering Corporation has opened new and larger offices for its subsidiary, CEC Instruments, Inc., at 285 Madison Ave., New York. Walter J. Beagan will be in charge.

Recent visitors from abroad at the **Eastern Regional Research Laboratory,** Philadelphia, were S. K. Barat, Central Leather Research Institute of India; W. B. Brittain, Science Service, Ottawa, Canada; and Hans Deuel, Agricultural Chemistry Institute, Zurich.

F. G. Ludwig Associates, formerly of Woodbridge, Conn., have moved to a new location in Deep River, Conn.

The **Memorial Center for Cancer and Allied Diseases,** New York, has completed its Physiology Laboratory–Betatron Building, a four-story building housing a 24 mev betatron, operating rooms for animal surgery, and extensive research laboratory facilities. The building completes the program the center began in 1939 with the opening of Memorial Hospital. Since then the Strang Cancer Prevention Clinic, Sloan-Kettering Institute, the McCann Children's Pavilion and James Ewing Hospital, and the Tower Outpatient Building have been added.

Minnichlor, Inc., a new firm at Enfield, Minn., 50 miles west of Minneapolis, is producing water-soluble chlorophyll from alfalfa. By-products of extraction, including carotene, xanthophyll, phytol, other vegetable fats, and spent meal, will also be marketed by the Minnesota firm.

Nuclear Research and Development, Inc., of St. Louis, have opened a branch laboratory and sales office in New York, at 33–61 Crescent St., Long Island City.

Changes in the **Office of Naval Research** include the return of Henry A. Imus from a year's service as scientific liaison officer at the London Branch. He will reassume his duties as head of the Physiological Psychology Branch, Washington, D. C. Leo A. Shinn, formerly in charge of the organic chemistry program of the Chemistry Branch, has replaced Louis Levin as head of the Biochemistry Branch, Biological Sciences Division. George Sprugel has been made acting head of the Biology Branch of the division while Sydney R. Galler is on a year's leave of absence to participate in a series of cruises sponsored by the Undersea Warfare Branch. One of the phenomena to be investigated will be the deep scattering layer.

Meetings and Elections

The Association of Geology Teachers, meeting in Boston with the Geological Society of America, will convene on Nov. 15 to hear the presidential address of Kurt Lowe, City College of New York; a discussion of "The Role of the Geology Teacher in Conservation Education," by Julius Kaikow; and a talk by Charles Behre on what makes a good geology teacher and how he can be developed.

The Association of Military Surgeons of the United States will meet at the Statler Hotel, Washington, D. C., Nov. 17–19, under the presidency of Harry G. Armstrong, Air Force surgeon general. A symposium on reserve affairs and reports on the newest advances in combat medical services and on air evacuation of the wounded, by officers recently returned from Korea, will feature the sessions. The program will include the following speakers: Louis H. Bauer, Otto Brandhorst, Melvin Casberg, J. A. McCallam, Lamont Pugh, Isador S. Ravdin, Howard A. Rusk, Oscar P. Snyder, and William L. Wilson.

The National Academy of Sciences will hold its autumn meeting Nov. 9–12 at Washington and St. Louis universities. Scientific sessions on Monday, Tuesday, and Wednesday mornings and on Wednesday afternoon will be held in Wayman Crow Hall and Louderman Hall, Washington University. Two of the eight sessions will consist of invited papers; a program in neurophysiology will celebrate the centenary of the birth of Cajal, and a symposium on "The Biochemical and Biophysical Regulation of Cellular Activity" will attempt to show the present status of that problem. A public lecture by Charles Allen Thomas, of Monsanto Chemical Company, on "The Problem of Resources" will be given in the Law School Auditorium of St. Louis University. Abstracts of the papers presented at the meeting will appear in the Nov. 14 issue of SCIENCE.

Xi Sigma Pi, honorary forestry fraternity, has elected the following officers to serve for the next two academic years: forester, Lenthall Wyman; associate forester, James S. Bethel; secretary-fiscal agent, William D. Miller. All three men are with the School of Forestry of North Carolina State College. The fraternity will publish a new directory of members in 1953.

Technical Papers

Tertiary Boulders in the Cretaceous of Puerto Rico

Raoul C. Mitchell
Mayagüez, Puerto Rico

Recently the author found some Tertiary boulders high in the interior of Puerto Rico where Cretaceous pyroclastics and sediments occur. Eight boulders, ranging from 4″–16″ in diameter, were found within an area of a few square yards in a stream bed. In composition they are silty and sandy, tan-colored marls with white inclusions of calcite, and they contain glauconite in small amounts. The boulders are subangular but smooth, though their surfaces are somewhat pitted. The only identifiable fossils are some poorly preserved foraminiferal forms belonging to the genera *Triloculina, Quinqueloculina,* and *Pyrgo.* On lithologic and faunal grounds, the boulders appear to belong to the upper part of the San Sebastián formation (Table 1).

The boulders were found up the left fork of a small, unnamed south-bank tributary that joins the Río Guaba 4 miles downstream from the source of the latter. The locality is in Barrio Indiera Fría, Municipality of Maricao, about 3 miles southeast of the town of Maricao (Fig. 1). The boulders lie at an elevation of 2160′. The source of the fork lies about 600′ southeast of the site, and the main east-west watershed of the island is about 1500 yards due south of the source at an elevation of 2660′. The rocks in the immediate vicinity include blue-black limy shales and brownish andesitic tuffs, which are probably the Peñuelas Shales of Mitchell (*1*). Badly weathered serpentines, saussuritized quartz-diorites, and diabases are present in the region, also.

Hubbard (*2*) is the only previous worker on the geology of Puerto Rico who mentioned finding a Tertiary boulder within the Cretaceous. His boulder occurred "in the channel of the Río Guayaba 2 miles SE of Aguada," which would place the locality at an elevation of 100′–160′ and approximately 1½ miles from the nearest Tertiary outcrop. He suspected that this boulder belonged to the Lares formation. A search was made for it without success. The local inhabitants do not know where the Río Guayaba is, and the topographic maps do not indicate it; probably Hubbard used the wrong name.

The nearest north coast Tertiary outcrop to the Guaba boulders is the San Sebastián formation, which is 10 miles away, the elevation of the top and base being 1148′ and 984′, respectively. To the south, the nearest Tertiary outcrop—the Lower Ponce Member—is 14 miles away. Thus, in the longitude of the boulders, the north and south coast Tertiaries are separated by 24 miles, with a maximum altitude of 2660′ between them.

A diligent search in the vicinity has failed to reveal any exposures of Tertiary rock *in situ.* In some scattered localities near at hand, however, there are soils that have a close similarity to the loams and silty clay loams of the Moca soils group of Roberts (*3*), which are extensively developed in the region of the San Sebastián formation between Moca and San Sebastián. Further, along the road from San Sebastián to Lares the writer has observed boulders, cobbles, and pebbles of Cretaceous rocks which could be considered as typical basal material of the San Sebastián formation. These two observations suggest the possibility of Tertiary rock *in situ* beneath the surface, but direct evidence of Tertiary outcrops is lacking. When consideration is given to the slope (10°) of the tributary from

TABLE 1

SUBDIVISIONS OF THE TERTIARY OF THE NORTH AND SOUTH COASTAL PLAINS OF PUERTO RICO

Thickness (ft)	North coast	Age	South coast	Thickness (ft)
1100	Aymamon Limestone	Lower Miocene	Upper Ponce Member	1312
246	Aguada "			
754	Cibao			
393	Guajataca Member			
	Marl	Lower Miocene to Middle Oligocene	Lower Ponce Member	2952
1312	Lares Limestone			
984	San Sebastián Formation		Juana Diaz Formation	2148

its source to the junction with the Río Guaba, the very steep valley sides (45° slopes and more are common), the angular nature of the boulders, it is to be presumed that gravity has been a more important agent of transportation than running water in any movements of the material.

The Tertiary formations of the north and south coast illustrate a marine onlap onto the Cretaceous rocks of the interior, but, as observed today, the oldest strata occur farthest inland because of more extensive erosion of the younger beds. The older Tertiary deposits at the outcrop areas have a somewhat higher dip than the younger strata, and the Tertiary of the south coast dips more steeply than that of the north coast. It is assumed that these are not initial dips but were acquired by tilting during the late Miocene uplift of the island.

Two possible explanations may account for the presence of Tertiary material high in the Cretaceous interior: (1) it may represent remnants of Tertiary deposition in an advancing sea within an embayment penetrating far into the interior of the island, or (2) it may represent remnants of Tertiary deposits which once covered the island—at least the western part.

Regarding the first possibility, there seems little doubt that an axis of subsidence extends in a NW–SE direction from the general region of San Sebastián on the north to Ponce on the south. The strike-profile of Zapp (*4*) clearly shows a deep embayment some 35 miles wide in the general longitude of San Sebastián, and it is here that the north coast Tertiary is not only thickest but also penetrates farthest south in its outcrop areas. The pre-Tertiary surface upon which deposition took place was highly irregular, and its relief was probably of the order of 1000′–2000′, perhaps more. From the end of Cretaceous to Middle Oligocene time, the island was undergoing denudation, and it is quite possible that the maximum elevation of Puerto Rico at the beginning of Tertiary deposition was considerably higher than the present 4400′. In spite of several attempts that have been made to correlate the Tertiary of the north and south coasts, a close agreement has not been reached, and Meyerhoff (*5*) is of the opinion that the northern and southern marine areas coalesced only in the region of Vieques Island, east of Puerto Rico. Thus, taking an average thickness for the north and south coast Tertiary of 5000′, even after a submergence of this amount, the island was not completely inundated, but a mountain axis of Cretaceous rocks still persisted in separating the Tertiary formations of the north and south coasts.

The second hypothesis, that the Tertiary once coalesced over the mountainous interior, deserves mention. Until recently, it was thought that Tertiary strata occur only along the north and south coasts. However, McGuinness (*6*) reports the finding of late Miocene faunas in core samples taken from depths of 80′–220′ in water wells in Mayagüez. Recently the writer has inspected cores taken during the construction of the

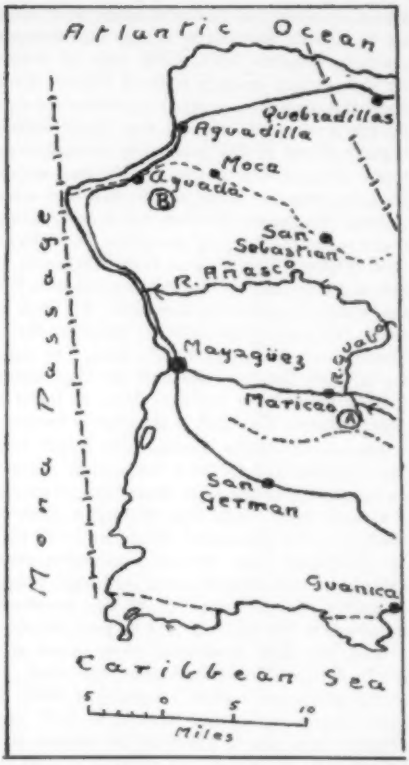

FIG. 1. Western Puerto Rico, showing boulder location and other features. *A*, Guaba boulders; *B*, approximate location of Hubbard's boulder; – – – –, limits of the north and south coast Tertiary; –·–·–·–, main E–W watershed of the island; –|–|–|–, axes of subsidence; ———, main roads.

Darlington Apartments in Mayagüez. The foraminifera *Archaias aduncus* (Fichtel & Moll) or *Archaias angulatus* (Fichtel & Moll) was identified from samples at a depth of 65′–68′. These species have been mentioned by Galloway and Heminway (*7*) as common in the Los Puertos (Aymamen Limestone) and Ponce formations, and the genus *Archaias* is considered indicative of the Upper Miocene Bowden Marls of Jamaica (*8*). We can therefore accept the presence of Tertiary at shallow depths, at least in the Mayagüez area of western Puerto Rico. As neither the McGuinness nor the Darlington samples came from great depth (maximum 220′), it is not known whether older strata lie below the late Miocene. The name Guanajibo formation has been proposed by McGuinness for these late Miocene beds.

We do not know whether strata younger than Lower Miocene may have been deposited along the north and south coasts, and later removed by erosion. The uplift giving rise to the St. John peneplain occurred in late Miocene–early Pliocene time, and hence it is possible

that beds younger than Lower Miocene were laid down along the north and south coasts. McGuinness (*6*) mentions a possible NNW–SSE axis of depression along the extreme western edge of Puerto Rico, and perhaps this sagging preserved later Miocene deposits along the west coast, whereas the higher arching to the east resulted in the erosion of contemporaneous deposits. Therefore it is conceivable that deposition took place along the north, south, and west coasts of the island. No known Tertiary rocks occur along the east coast, but Tertiary is presumed to underlie the shallow Vieques Sound, and Lower Miocene strata appear at the surface in southern and eastern Vieques Island, which, according to Meyerhoff (*5*), show a gradational fauna—i.e., gradational between the north and south coast faunas of Puerto Rico. The eastward tilting of both the St. John and the Caguana peneplains has carried the Tertiary down to lower levels in eastern Puerto Rico and in the islands farther east.

In Jamaica the White Limestone of Upper Eocene–Middle Miocene age forms a framework around the Cretaceous rocks of the Blue Mountains, extending as high as some 4000′, with Blue Mountain Peak rising to 7300′. It is the opinion of Trechmann (*9*) that the White Limestone once formed a covering over the Cretaceous of the highest areas, although today the north and south coast outcrops of this limestone are 24 miles apart. He believes that in post-Middle Miocene time, the Blue Mountains were raised at least 3000′. In Puerto Rico, remnants of the older, or St. John, peneplain occur at an elevation of 3000′ in the Adjuntas–Lares region and descend to 1500′ in eastern Puerto Rico and to 1000′ in the western part of the island. This peneplain was elevated in earth movements associated with world-wide diastrophism toward the end of the Miocene. It is not unreasonable, therefore, to postulate that the Tertiary formations of the north, south, and west coasts of Puerto Rico, which seem comparable to the Upper White Limestone–Bowden Marl of Jamaica in regard to faunal content and age, also covered the island of Puerto Rico.

Both these explanations are based on the supposition that Tertiary *in situ* occurs at elevations as high as 2160′. The possibility of Tertiary *in situ* beneath the surface in the Río Guaba region cannot be excluded, even although none has been found, and we are dealing here with boulders, not outcrops. As remarked previously, the subangular boulders appear to belong to the upper part of the San Sebastián formation, and there are indications in the vicinity that the Cretaceous boulders, cobbles, and pebbles may have formed the basal material of the same formation. The presence of these "exotic" upper boulders now lying in a milieu of basal material can be accounted for by gravitational movement down the steep Cretaceous surfaces, in the manner of scree formation.

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Quantitative Studies on Proteolipide as Incitant of Disseminated Encephalomyelitis in Mice

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The identification of the agent present in brain tissue that produces experimentally disseminated (allergic or isoallergic) encephalomyelitis that bears certain resemblance to the human demyelinating encephalitides has been advanced recently by the finding that proteolipide (*1*), a new type of lipoprotein, can reproduce the affection in mice (*2*).

In view of the fact that there has been no uniformity of opinion hitherto on the chemical nature of the incitant of the experimental disease (*3*), it was thought desirable to report additional evidence for consideration of brain proteolipide as the etiological factor of the experimental encephalomyelitis in mice. The evidence is based on a quantitative study of its encephalitogenic potency and derives, first, from the correlation of its concentration with the degree of reaction in mice and, second, from the inability of brain tissue of newborn mice to produce encephalomyelitis, for their tissues do not contain proteolipide (*4*). With respect to the first, the data collected concern (*a*) the number of reactors after injection and (*b*) degree of the reaction; (*c*) the number of days from the first injection to onset of signs; (*d*) the number of injections needed to induce a reaction and (*e*) the minimal time required to bring about a maximum reaction, presented in Table 1 as number of days times number of injections. In Table 1 will be found a summary of one example of a repeated experiment.

The preparation of mouse brain proteolipide followed the method of Folch and Lees (*1, 2*), and the proteolipide was obtained from 150 fresh brains (which weighed 60 g) of 2–4 months old W-Swiss mice. An additional test was made with proteolipide

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TABLE 1

THE QUANTITATIVE STUDY OF THE ENCEPHALITOGENIC ACTIVITY OF PROTEOLIPIDE AND NEWBORN MOUSE BRAIN

Material	No. with signs			No. symptom-free but with CNS lesions	Reactors		B/A	Cumulative time and no. injections to onset			C×D/A
	A	B						C		D	
	No. of mice	Non-paralytic	Paralytic		Total no.	Per-centage		No. mice	Days	No. injections	
Proteolipide from 150 brains*	20	0	20	0	20	100	1	6	6	1	3.0
								8	9	2	
								9	14	2	
								10	15	3	
								11	16	3	
								13	17	3	
								20	20	3	
Proteolipide from 25 brains*	21	6†	11	4	21	100	½	2	6	1	6.7
								4	9	2	
								6	14	2	
								11	17	3	
								12	18	3	
								14	22	4	
								16	27	4	
								17	28	5	
Whole, normal adult mouse brain (control)	20	13†	5	2	20	100	¼	4	5	1	11.1
								5	8	2	
								6	16	3	
								7	19	3	
								9	23	4	
								11	26	4	
								12	28	5	
								14	33	5	
								18	37	6	
Whole, normal newborn mouse brain	20	0	0	0	0	0	—	0	60	6	—

* These separate residues, after proteolipide extraction, of the 150 and of the 25 brains were inactive in 35 mice. The RD_{50}, dry weight, for whole brain = 0.40 mg/ml ($= 10^{-2.72}$); for proteolipide, 0.013 mg/ml ($10^{-2.02}$).

† These showed neurological signs, such as paresis, tremors, weakness, excitability (5) but no extensive paralysis, as in Column B.

diluted 1:6, to equalize the weight of tissue used as control. The latter comprised 25 whole brains, or 10 g of tissue, secured from normal adult mice; 65 whole brains of 4-day old Swiss mice, yielding 10 g of tissue, were also included (Table 1). Each of these materials was mixed with the Freund-type adjuvant and homogenized in a Waring blendor for 2 min, as already described (*2, 3*). The methods, the use of H-line W-Swiss mice (*6*) as animals of choice for inoculation, and other details of procedure have been stated before (*3, 5*).

The tabulated results indicate clearly that proteolipide deriving from mouse brain induced encephalomyelitis in mice to a greater degree than did whole adult mouse brain. There is a correlation between the concentration of proteolipide and the degree of reaction noted in inoculated animals. Finally, newborn mouse brain from which no proteolipide is obtainable, treated in the same manner as adult brain, failed to bring about the disorder. It has already been shown that all the encephalitogenic power of mouse brain resides in the proteolipide fraction (*2*). The present results would therefore appear to confirm this finding.

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Fluorescence in Ultraviolet Light in the Study of Boron Deficiency in Celery

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A better understanding of boron deficiency in celery, *Apium graveolens* L. var. *dulce* Pers., has been attained by observing symptoms of brown checking and

cracked stem under ultraviolet light. The present report considers two fluorescent conditions associated with these symptoms.

Brown checking and cracked stem refer to two types of symptoms exhibited by a single physiological disease which occurs in most celery districts of California. Brown-checking symptoms appear on the adaxial side of the petiole along the median axis. On the main petiole, the affected area is commonly 0.4–0.9 cm wide and 3.6–11.0 cm long on the upper one

FIG. 1. Field-grown celery showing early boron-deficiency symptoms on the adaxial side of a petiole. Left figure photographed in visible light; right figure shows visible fluorescence induced by ultraviolet light. Note bright area which fluoresces blue around lesions.

half to two thirds of the petiole. The lesions, involving the necrosis of superficial parenchyma and collenchyma cells, are brown, and in advanced stages of the disease they usually have conspicuous transverse cracks.

In the major celery varieties grown in California the brown-checking symptoms are predominant. Of 298 plants with these symptoms collected from five celery districts in California, 48.3% also exhibited cracked stem in varying degrees. Plants with both types of symptoms are more seriously affected than those with brown checking alone. Cracked stem appears on the abaxial side of the petiole. The primary symptoms are numerous isolated cracks across the ribs or small tears on the ribs; in advanced stages the affected tissue becomes brown in color. Both types of symptoms also occur on the upper rachis and secondary petioles.

Cracked stem in celery is attributed to boron deficiency by Pruvis and Ruprecht (*1*), Maier (*2*), and Reed (*3*). Studies now in progress by other members of the Department of Vegetable Crops and by the Extension Service, suggest that boron deficiency in the plant is a factor causing brown checking. Symptoms on both the inside and outside of the petiole are reported by Bardin and McCormick (*4*) and Lachance *et al.* (*5*). The latter also describe a condition of heart atrophy as the most severe symptom of cracked stem.

In the phase of the work reported here, macroscopic examinations were made under ultraviolet light on affected plants from commercial fields, and on plants grown in nutrient solution at deficient levels of boron (0.0–0.05 ppm) in the greenhouse at Davis. Plants were also grown in nutrient solution at normal and toxic levels of boron. An A-H4, 100-w mercury lamp with Corning filter 5860 (color spec. 7–37) provided peak ultraviolet radiation at the 365 mμ line of the mercury arc spectrum. Several Utah varieties of celery were observed in this study, of which the principal one was Utah 10-B.

Blue fluorescent characteristics of the disorder. Under ultraviolet light normal young, growing petioles appear dull reddish green. In contrast, the early brown-checking symptoms on the inside of the petiole exhibit a bright, light-blue fluorescence around the affected tissue, extending about 3 mm beyond the margin of the lesions (Fig. 1). In effect, the fluorescence resembles a blue halo around the lesion. This blue fluorescence also extends within the tissue of the petiole to a depth of about 3 mm. The blue color, most intense near the necrotic cells, diminishes in intensity with distance from them. Petioles with symptoms on the abaxial side develop a blue fluorescence in the living tissue adjacent to the cracks; a blue fluorescence is associated also with some mechanical injuries to the petiole.

Although early brown-checking symptoms commonly have a characteristic location on young, growing leaves, they are often quite inconspicuous or not apparent when viewed under visible light. The vivid fluorescence associated with them, however, makes possible the detection of incipient stages of the disorder.

The development of a blue fluorescence in relation to a variety of diseases and injuries in plants may be more significant than has heretofore been realized. It is reported in several species of the Solanaceae, especially in the potato (*6–11*), and also in citrus fruits (*12, 13*). I have also observed intense, light-blue fluorescent halos around the necrotic lesions of "internal cork" in sweet potato. Best (*14*) and Andreae (*11*) working on tobacco and potato, respectively, have identified a blue fluorescing material as scopoletin. The possible metabolic role of this coumarin compound in plants has been discussed recently by Best (*15*), Andreae and Andreae (*16*), and Goodwin and Kavanagh (*17*). Bottini (*18*) identified several blue-fluorescing compounds in injured citrus fruits, including two derivatives of coumarin in the lemon and the bergamot orange. The relationship of the coumarins to necrosis and wounding should be explored further.

Yellow fluorescent characteristics of the disorder. A second fluorescent phenomenon associated with brown checking and cracked stem in celery is the dis-

play of a bright-yellow or gold color on the surface of adaxial and abaxial lesions (Fig. 2). The fluorescence is not general over the lesion, but occurs in small scattered spots or flecks on the surface. In some cases the flecks are so numerous as to give the lesion an over-all yellow appearance. This fluorescence is absent in some lesions, and in others it is weakly developed because the spots of fluorescing material are small and scattered. The material is a dry exudate, which may develop wherever the surface tissue is broken. The nature of this material is unknown. Under the unfiltered light of a mercury lamp it appears colorless, whereas under an incandescent lamp it is light tan in color. Of 298 affected plants collected from five celery districts, 87.9% showed some degree of yellow fluorescence. Usually, plants with severe symptoms display a striking fluorescence, whereas plants with moderate or weak symptoms may show little or none. In individual plants, the fluorescence is best developed on mature leaves having lesions, is less well developed on younger affected leaves, and does not occur at all on leaves with incipient lesions. In plants grown in nutrient solutions deficient in boron, lesions on both the inside and outside of the petiole often develop a high degree of yellow fluorescence very much like that occurring in field-grown plants.

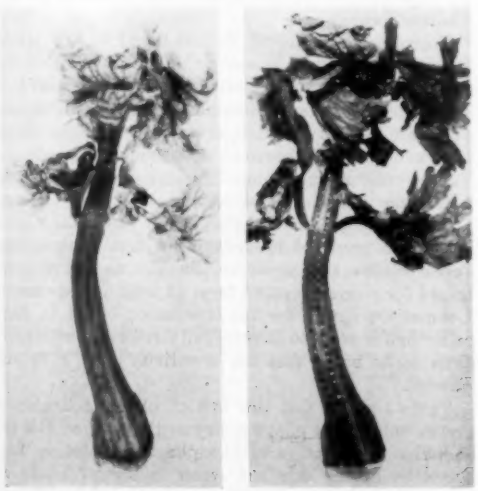

FIG. 2. Celery grown in boron-deficient (0.03 ppm) nutrient solution showing advanced symptoms on the abaxial side of the petiole. Left figure photographed in visible light; right figure shows visible fluorescence induced by ultraviolet light. Note bright spots which fluoresce yellow on cracks along ribs of petiole.

Plants grown at toxic levels of boron (10.0 and 33.0 ppm) develop superficial brown necrotic areas on the ribs and on the adaxial side of the petioles. These lesions, which do not initially involve any of the collenchyma tissue, appear as russeted or beaded vertical streaks. Transverse cracks may also develop on either side of the petiole in association with the affected tissue. The surfaces of these lesions, in contrast to those of plants grown in deficient boron, do not show any distinctive macroscopically observable fluorescence under ultraviolet light.

To determine whether yellow fluorescence is exhibited by other diseases and injuries in celery, plants from most of the celery districts were examined. Growth cracks and miscellaneous injuries occasionally showed weak displays of yellow fluorescence; diseases including aster yellows, blackheart, late blight (*Septoria*), pink rot (*Sclerotinia*), and western celery mosaic had little or none. In no instance where such fluorescence occurred could the symptoms be misinterpreted as being those of brown checking or cracked stem.

Yellow fluorescence has been observed over a period of two growing seasons in a wide range of celery material from both the field and that grown in boron-deficient nutrient solutions. Although there is considerable variation in the display of fluorescence by plants with brown checking and cracked stem, it is frequently prominently developed in celery thus affected. The yellow fluorescence may be considered as an added feature in the array of symptoms exhibited by plants with this disorder. Its significance in relation to boron deficiency in celery is not as yet understood.

The parallel development of similar fluorescent conditions in plants grown in the field and in nutrient solution supports other phases of this study which implicate boron deficiency in the plant as a factor causing brown checking and cracked stem. These fluorescent conditions also serve as an aid in the study and diagnosis of the disorder.

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Absence of Photoreactivation in T1 Bacteriophage Irradiated with Ultraviolet in the Dry State[1]

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Photoreactivability of bacteriophages, following ultraviolet irradiation, has been shown (*1*) to depend on adsorption to the host bacterium and on factors influencing the state of the phage-bacterium complex, such as the metabolic state of the host, temperature, etc. The present paper deals with the finding that the state of the phage itself, at the time of exposure to UV, has a very marked effect on the subsequent reversibility of the damage.

Bacteriophage T1, as already reported (*2*), is stable in the dry state. In our experiments, uniform dry preparations were made by spraying from an all-glass commercial penicillin nebulizer. The phage was collected on glass cover slips, 18 mm in diameter. The cover glasses were supported in circular depressions, provided at the periphery of a rotating platform, so that 8 could be prepared at once. The spraying was done inside a cardboard box.

Suspensions of T1 in broth and in 2% ammonium acetate (*3*) were used for spraying. The latter were prepared by centrifugation of a broth stock and resuspension of the phage in the new medium. Assays of the dried phage were carried out by dropping the cover glasses into 5 ml of broth, diluting further in broth if necessary, and plating by the Hershey agar-layer technique (*4*). In experiments requiring a determination of the recovery of phage after drying, Na^{24} was added to the phage suspension, which was to be sprayed, in a final concentration of about 5 μc/ml. (The injury to the phage due to β- and γ-radiation is far too small to affect the results.) The dry samples were counted with a Geiger counter, along with a standard reference preparation obtained by pipetting 0.02 ml of a 1/100 dilution of the phage-Na^{24} suspension onto a cover glass and allowing this to dry at room temperature. From the ratio of radioactive counting rates and the phage titer of the original suspension, it is a simple matter to calculate the volume sprayed onto each coverslip (10^{-3}–10^{-4} ml) and the total number of phages in a given preparation. Although these preparations will be referred to as "dry" in what follows, it is of course possible, and indeed likely, that the phage retains some water of hydration that is not removed by this procedure.

Phage T1 is as stable in 2% ammonium acetate as it is in broth. Spraying of a broth suspension yields better than 90% recovery of viable, dry phage and is quite reproducible. However, spraying of an acetate suspension results in only about 10% recovery and, although different cover glasses show the same counting rate, and hence the same total number of phages, the viable titers may vary by as much as a factor of 2 or 3. Therefore, when it was desired to run a radiation survival curve on these preparations, several determinations had to be averaged to obtain significant data for each point. In spite of these limitations, the acetate-sprayed dry preparations have an advantage in that the suspension medium is completely evaporated, as shown visibly and in electron micrographs.

The source of UV was a 15-w G-E sterilamp, and the sample distance from the center of the lamp was 56 cm. Photoreactivation was carried out by the plating method (*1*)—i.e., by immediate exposure of the phage plated with a large excess of *Escherichia coli*, strain B, to the reactivating light. This was provided by an H-5 lamp, filtered to give a band peak at 3650 A, the most efficient wavelength for this system (*1*). The lamp was 1 ft from the agar plate, and a 1-in. layer of .05 *M* Cu Cl_2 was placed between the lamp and the plate, to minimize heat inactivation. The time for maximum photoreactivation was determined to be ½ hr, but all plates were routinely exposed for 1½ hr before incubation in the dark. A comparison set of platings was carried out in the dark, followed by immediate incubation.

Comparison studies of T1 irradiated by UV while in solution were done according to established methods (*5*). A broth stock was diluted 100-fold in either Mg-saline buffer[4] or ammonium acetate, and 5 ml irradiated in a 10-cm Petri dish, at the same distance from the sterilamp, with constant agitation.

The result of irradiating T1 in the dry state is that, within the limits of experimental error, the damage is no longer photoreactivable. This is shown in Fig. 1 for phage prepared by spraying a broth suspension (open circles and squares). Similar data were obtained for phage prepared from an acetate suspension. Comparison curves for the irradiation of T1 in Mg-saline buffer are also shown (full circles and squares). It is to be noted that the sensitivity to UV is not affected.

Table 1 shows that this loss of photoreactivability occurs only if the phage is dry at the time of UV irradiation. Irradiation of the phage in solution followed by drying does not result in loss of photoreactivability. The same is true for drying of the phage, followed by resuspension and irradiation.

The figures in Table 1 might suggest that dried phage is more sensitive to UV, since 60 sec of UV inactivate dry phage by a factor of about 50, whereas the titer in acetate drops by a factor of about 20. This discrepancy, however, might be ascribed to some sort of protective mechanism acting in the acetate suspension. If phage is irradiated in buffer, the factor is 50

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[2] Atomic Energy Commission predoctoral fellow in biophysics.

[3] The authors wish to express their indebtedness to G. Failla and A. D. Hershey for many helpful discussions and constant encouragement.

[4] Na Cl, 0.15 *M*; Mg SO_4, 10^{-3} *M*; Na_2HPO_4, 10^{-3} *M* (pH adjusted to 6.5).

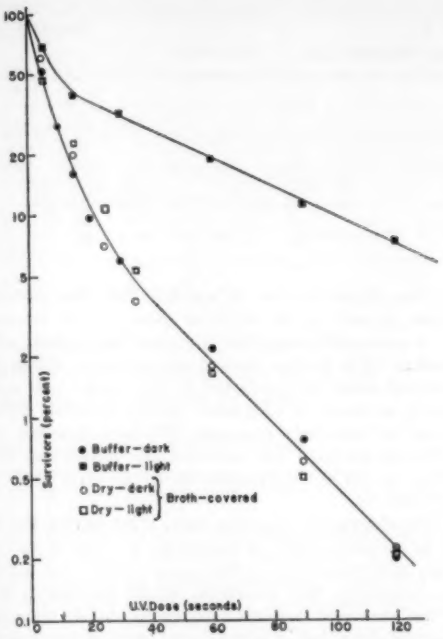

FIG. 1. UV inactivation (dark) and photoreactivation (light) of T1 irradiated in buffer solution and in dry preparations made by spraying a broth suspension.

also. There seems to be no reason to assume that the survival in the dry state should be compared with the acetate suspension rather than the buffer suspension, since drying leads not only to evaporation of water, but also to sublimation of ammonium acetate. It has not as yet been determined whether the lowered sensitivity in acetate is due to UV absorption in this medium or to some protective effect.

The experiments were carried out at room temperature. The effect also persists, however, at lower temperatures. This was shown by experiments in which the cover glass preparation was supported inside a watertight cell supplied with a quartz ceiling. The cell was filled with Drierite and kept in a water bath at 5° C for ½ hr before irradiation, in order to ensure temperature equilibrium. No photoreactivation was detected either for the phage irradiated at 5° or at 25°. The effects of temperatures above 25° C are under study.

Since the UV survival curve is unchanged in the dry state, it seems likely that inactivation proceeds by the same mechanism. It would appear, however, that photoreactivation of some of this damage requires not only adsorption to bacteria and application of light but is also dependent on the state of the phage at the time of UV exposure.

TABLE 1*

EFFECT OF DRYING ON PHOTOREACTIVATION OF PHAGE

Treatment	Assay	Ratio (UV) : (UV → PR)
A	1.0×10^{10}	
A → UV	5.0×10^{9}	1 : 6.2
A → UV → PR	3.1×10^{9}	
A → D	1.3×10^{9}	
A → D → UV	2.8×10^{7}	1 : 1.4
A → D → UV → PR	3.9×10^{7}	
A → UV → D	8.8×10^{7}	1 : 5.6
A → UV → D → PR	4.9×10^{8}	
A → D → A → UV	8.3×10^{7}	1 : 6.3
A → D → A → UV → PR	5.2×10^{8}	

* *A* refers to suspension (also resuspension) of T1 in 2% ammonium acetate, *D* to drying, *UV* to a 60-sec exposure to the germicidal lamp, and *PR* to exposure to the H-5 lamp of sufficient duration to obtain maximal reactivation. All data are normalized to an initial titer of 1.0×10^{10}.

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Greater Resistance of the Female to Experimental Burns Following Starvation

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In the course of experimentation in the chemoprophylaxis of burns (*1, 2*), certain trends in the survival rates of intact rats subjected to thermal injury were observed that could not, under the conditions described, be unequivocally attributed to sex factors. In order to investigate sex differences under more rigorous conditions, starvation was selected as an additional stressor prior to burning. Since it has long been known that liver lipids increase during fasting (*3*), and, more recently, that under fasting conditions the lipid accumulation is higher in the liver of the female than in that of the male (*4*), it was hoped that the marked lipotropism seen in the starved female would be a factor in increasing the female survival rate over that of the male after burns. Of the lipotropic substances, only methionine has to our knowledge been tested in burns and found to be protective (*5*). Accordingly, each of three groups of albino rats consisting of nearly equal numbers of males and females of similar body weights was starved for 50, 75, or 100 hr, anesthetized with pentobarbital sodium, immersed up to the neck in water at 75° C for 20 sec, according to the method of Hazán and Treadwell (*5*), and returned to a standard diet. Water was available

TABLE 1

SEX DIFFERENCE IN BODY WEIGHT LOSS

Duration of starvation	MF	50 hr	75 hr	100 hr
No. animals	M	18	18	19
	F	19	20	18
Mean initial body weight and range (g)	M	165 (122–205)	166 (125–200)	164 (124–200)
	F	162 (115–195)	163 (119–208)	162 (130–198)
Body weight loss (% of initial)	M	22	27	31
	F	18	21	24

at all times. A series of animals of similar body weights and equally divided as to sex, but well fed, was included and burned under the same conditions as the starved animals.

The percentage body weight lost by each of the starving groups for the period between the beginning of starvation and the time of burn is tabulated with related data in Table 1. It may be noted that (*a*) within any one level of starvation males appear to suffer a greater loss of body weight than females, and that (*b*) the percentage weight loss of males at 50 and 75 hr of starvation either equals or exceeds that of females at 75 and 100 hr, respectively.

When survival rates of fasting burned males are compared to those of similarly treated females (Table 2), it is quite evident that at the stated levels of starvation the female survival rates at 12, 24, or 48 hr post-burn are higher than that of males at the same time intervals. Although the number comprising each group is small, nevertheless it is of interest that if the level of significance is set at a probability of 1% or less for the absolute number of animals in each group surviving at 12 or 24 hr, a statistically significant sex difference is apparent in animals starved for 75 or 100 hr but not in those fasting for 50 hr, though here, too, the males suffered a higher mortality. When the number of survivors at all levels of starvation is grouped by sex, a statistically significant sex difference is evident again at the same 12th or 24th hr post-burn.

In the administration of a lethal burn the survival times, as well as the survival rates, are of interest. It is noteworthy that the last surviving female outlived by 48 hr the last starved male survivor. When the survival rates of nonfasted burned males are compared to those of nonfasted burned females, differences are not easily apparent. We have, however, insufficient grounds for rejecting the hypothesis that there are no sex differences in the survival rates of fed rats.

The observation that the male, after having lost in 50 hr as much weight as the female in 75 hr of starvation, still evidenced a higher mortality does not negate the possibility that the factor of the sex-related differential weight loss may be causal in determining survival rates, but is indicative at least of other *modi operandi*. In evaluating possible mechanisms of action one must cite, besides anatomical sex differences, the differential processing of male and female gonadal hormones by the liver (*6*). This process is accentuated in starvation, resulting in an increased estrogen/androgen ratio. Estrogens or progesterone may thus offer the female greater protection against burns either directly or through lipotropic actions, or through the intermediary of other indirect metabolic pathways. The work of Cowie (*7*) points to a sex difference in the survival time of adrenalectomized rats in favor of females. These findings lend further support to the inference that sex-related endocrine factors may be

TABLE 2

SEX DIFFERENCE IN MORTALITY

Groups	Sex	No. survivors (hours post-burn)					
		0	3	12	24	48	72
Unfasted	M	13	12	7	5	4	2
50-hr fast		18	17	6	5	0	0
75-hr "		18	17	4	0	0	0
100-hr "		19	16	3	0	0	0
Unfasted	F	13	9	6	5	3	3
50-hr fast		19	18	11	9	1	1
75-hr "		20	15	14	11	1	0
100-hr "		18	15	12	8	1	1
Fasting groups (totals and % surviving)	M	55 (100%)	50 (91%)	13* (24%)	5* (9%)	0 (0%)	0 (0%)
	F	57 (100%)	48 (84%)	37* (65%)	28* (49%)	3 (5%)	2 (4%)

* $p = < 0.01$ when comparison is made by chi-square (Yates' correction) between absolute number of fasting male and female survivors at the same time interval after burn.

operative in the greater resistance of starved female rats to burns.

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The Effect of Applied Sugars, Light Intensity, and Temperature upon the Chemical Defoliation of Cotton[1]

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In experiments (*1–3*) conducted during the past two years it was noted that the addition of sucrose to defoliant sprays generally resulted in increased defoliation of the cotton plant. This response was more consistent in greenhouse-grown plants than in field plants (*1*). These results appear to be contrary to the effects of sucrose upon abscission obtained by other investigators (*4–6*) working with various species. Went and Carter (*6*) reported less abscission of flowers and increased fruit set in tomato following the application of sucrose under conditions of high temperatures and low light intensity. Livingston (*5*), working with citrus explants, and Brown and Addicott (*4*), using bean explants, obtained a retardation of the abscission process when sucrose was applied daily.

Most workers (*7–10*) seem to agree that hormone phytocides, particularly 2, 4-D, are absorbed into the leaf in the dark better than, or as well as, in the light, but there is probably no translocation of 2, 4-D from the leaf in complete darkness or from one that has been made starch-free. Moreover, other workers (*8–12*) have reported that the addition of sugars to leaves devoid of translocatable carbohydrates resulted in transport of 2, 4-D, as well as other synthetic auxins from leaves kept in the dark.

Because of the apparent importance of sugar in the translocation of materials from the foliage and the opposite effect noted upon abscission (seemingly depending upon whether sucrose was applied alone or in combination with defoliants), it appeared worth while to study the phenomenon in greater detail. To accomplish this an experiment was undertaken whereby chemically induced defoliation could be followed in cotton plants maintained under varying conditions of light intensity, temperature, and sugar supply.

On June 19, 1951, young, preflowering Stoneville 2B cotton plants, grown outside in fertile soil in 3-gal jars, were selected for uniformity and divided into eight lots of 16 plants each, 4 plants per jar. Duplicate lots were placed under the following conditions of light and temperature: *A*, Lots 1 and 2, outside in high light intensity (8000–10,000 ft-c at noon), high temperature (96° F av max, 72° F av min); *B*, Lots 3 and 4, moderate light intensity (3000–5000 ft-c at noon), moderate temperature (88° F av max, 74° F av min); *C*, Lots 5 and 6, darkness and high temperature (mean 98° F); and *D*, Lots 7 and 8, darkness and moderate temperature (mean 83° F).

On June 23, when starch could no longer be detected in the leaves of plants placed in the dark (Lots 5–8, inclusive) by the I_2KI test, aqueous solutions of 3% Shed-A-Leaf (sodium chlorate–pentaborate) and 2% Endothal (disodium 3, 6-endoxohexahydrophthalate + ammonium sulfate) were prepared, as well as other solutions of the defoliants, plus 2.5% of the various sugars as indicated in Table 1. The plants were then treated as indicated (Table 1) by rolling the leaf slightly to facilitate immersing it into a beaker of test solution, the excess allowed to drain, and the procedure repeated for all leaves in a given treatment. On the average each treatment included 32–36

TABLE 1

THE EFFECTS OF SUGARS, LIGHT INTENSITY, AND TEMPERATURE UPON THE CHEMICAL DEFOLIATION OF YOUNG COTTON PLANTS

Defoliated with Endothal		Defoliated with Shed-A-Leaf	
Sugar Additive	% Abscission	Sugar Additive	% Abscission
Lots 1 and 2			
Endothal Control	50	Shed-A-Leaf Control	60
Dextrose	80	Dextrose	84
Levulose	70	Levulose	88
Sucrose	92	Sucrose	84
Lots 3 and 4			
Endothal Control	40	Shed-A-Leaf Control	60
Dextrose	60	Dextrose	85
Levulose	100	Levulose	93
Sucrose	100	Sucrose	90
Lots 5 and 6			
Endothal Control	10	Shed-A-Leaf Control	6
Dextrose	45	Dextrose	95
Levulose	70	Levulose	92
Sucrose	70	Sucrose	80
Lots 7 and 8			
Endothal Control	Lethal	Shed-A-Leaf Control	5
Dextrose	"	Dextrose	90
Levulose	25	Levulose	100
Sucrose	Lethal	Sucrose	100

[1] Published with the approval of the director of the Texas Agricultural Experiment Station as Technical Article No. 1584.

leaves. After treatment Lots 5 and 6 were placed under shade in diffuse light in the greenhouse (maximum light intensity 200 ft-c) to check the effects of light after starch depletion, and Lots 7 and 8 were retained in the dark following treatment.

Twenty-four hr after application abscission had begun on plants in the dark treated with the defoliant-sugar combinations, but none had occurred on plants in the dark treated with the defoliants alone. Also, at this early date abscission had become initiated in the plants kept in the light, with and without sugar additions to the defoliants.

Ninety-six hr after treatment abscission was mostly complete, and defoliation counts were made. These are recorded in Table 1 as the average percentage abscission per treatment. The results show a general increase in percentage abscission when sugar, regardless of type, was added to the defoliant, over the defoliant alone. This effect was noted under high light intensity and temperature conditions as well as under moderate light intensity and temperature conditions. The importance of translocatable carbohydrates in the abscission process was demonstrated by the difference in response of the starch-depleted plants kept in the dark when they were treated with the sugar-defoliant combination compared to the defoliant alone. This effect appears to be due primarily to the addition of sugar. When plants were placed in diffuse light after starch depletion in the dark (Lots 5, 6), they did not respond much differently to the defoliant than those kept continuously in the dark (Lots 7, 8), unless sugar was supplied. It is apparent that the form of sugar (at least among the three types tested) is not critical.

It should also be pointed out that in other work (*3*) we have obtained, in agreement with others (*4–6*), a retardation of abscission by spraying cotton plants with sucrose prior to chemical defoliation or by using a high sucrose concentration with the defoliant. The disparity between the inhibiting effect of sucrose and the accelerating effect obtained by applying the defoliant with a lower concentration of sucrose is not clear at this time. This point is now being investigated.

Repeated research has clearly assigned to sugar a definite role in metabolic absorption by the root. The function of an ion-binding substance formed from sugar accounting for the transport of inorganic ions across the root cell has been postulated (*15*). Weintraub and Brown (*10*) considered their results with sugar and growth-regulators inconsistent with the idea of a definite combination occurring between the two. However, the possible role of sugar in an ion-binding or complex formation capacity in the leaf should be more carefully investigated before definite conclusions can be formed.

Juhrén and Went (*14*) have also suggested a tonic or protective effect of sugar on plant cells. This effect, in light of the known toxicity of chemical defoliants as well as the role of soluble carbohydrates in polar translocation of metabolites, respiration, and abscission (*2, 15*), needless to say, needs further study.

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Lipid Detection in Paper Electrophoresis

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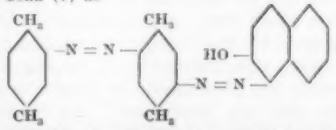
In the course of an investigation of protein-lipid relationships in serum by paper electrophoresis (to be reported elsewhere), several lipophilic dyes have been examined. In our experience the dye oil red 0[1] has proved to be superior to any other examined, including Sudan III, which was used by Bennhold (*2*) in following the migration of lipid serum components with the electrophoresis apparatus of Michaelis and which has recently been used in paper electrophoresis by Fasoli (*3*).

Fig. 1 illustrates results obtained with oil red 0 compared to bromphenol blue staining (*4*) for a normal and a pathological serum. Photoelectric scanning patterns, which were automatically recorded, are included for each strip. The bromphenol blue strips were scanned at 590 mμ and the oil red 0 strips were scanned at 525 mμ in an apparatus to be described elsewhere.[2]

Strip *A* is a bromphenol blue pattern of a normal

[1] Oil red 0 is sometimes confused with Sudan II. The latter has Color Index No. 73, whereas oil red 0 has not been assigned a Color Index number. The formula for oil red 0 is given by Conn (*1*) as



[2] The particular bromphenol blue scanning patterns presented here show albumin areas which are known to be relatively low. This is due to the high optical density of the albumin zone which for these strips exceeded the linear range of the instrument. Grassman and co-workers (*5*) have described another direct scanning apparatus for paper strips.

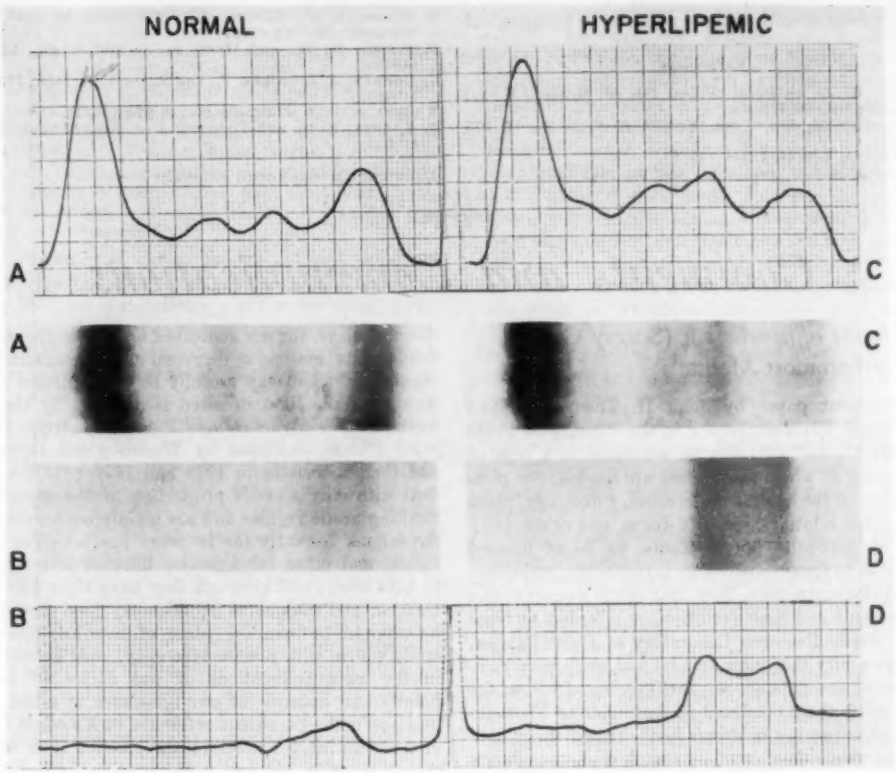


FIG. 1. Paper electrophoretic patterns of normal and hyperlipemic sera.

human serum with a total cholesterol (*6*) value of 200 mg/100 ml, $S_{f\ 11\text{-}21}$ 6 mg/100 ml (*7*), $S_{f\ 20\text{-}100}$ 5 mg/100 ml. Strip *B* is an oil red 0 pattern of the same serum. Strip *C* is a bromphenol blue pattern of a serum from a patient with arteriosclerotic heart disease who had had a recent myocardial infarction and whose total cholesterol was 445 mg/100 ml, $S_{f\ 11\text{-}21}$ 100 mg/ml, $S_{f\ 20\text{-}100}$ 342 mg/100 ml. Strip *D* is an oil red 0 pattern of the same serum. These patterns were prepared by the paper electrophoresis method previously described (*4*). They were all prepared simultaneously in the cell described in (*8*) with 0.01 ml of the sera streaked across the apices of 29 mm wide strips of Whatman 3 MM filter paper. The buffer was veronal, pH 8.6, ionic strength 0.05. A potential of 200 v was applied for 6 hr. After this time the strips were dried in an oven at 110° for 10 min.

The bromphenol blue strips (*A* and *C*) were then placed for 16 hr in a dye bath of the following composition: bromphenol blue 100 mg, glacial acetic acid 50 ml, and mercuric chloride 50 g, with water to make 1 liter. Then the strips were rinsed for 5 min in each of three changes of 2% acetic acid,[3] followed by a final rinse of 10 min in 2% acetic acid containing 0.5% sodium acetate (to provide a pH at which bromphenol blue will be in its blue form), blotted, and dried in the oven.

The oil red 0 strips (*B* and *D*) were stained for 16 hr in a bath comprising a saturated solution of the dye in 60% ethanol, with a tap-water rinse followed by blotting and drying. The resulting strips show a red pattern against a pink background.[4] (Both strips *B* and *D* also show a faint red band corresponding to the albumin position, which is not satisfactorily reproduced in the photograph.)

Using the technique as described above, 14 sera with elevated lipoprotein content (Gofman [*7*] $S_{f\ 11\text{-}21}$ range 63–136, mean 82) were compared with 15 sera of lower lipoprotein content ($S_{f\ 11\text{-}21}$ range 2–19, mean 12). The patterns selected in Fig. 1 are typical of these two groups. A study is in progress of the

[3] Kunkel and Tiselius (*9*) have pointed out the value of acidifying the rinse water.

[4] In common with other investigators we have observed that the serum lipoproteins appear to be strongly adsorbed on filter paper; however, this does not preclude comparative studies.

possible relationship of these patterns to pathological states.

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Comments and Communications

Cochlearia officinalis s.l. (Scurvy Grass) in Northernmost Alaska

The recent paper by John H. Thomas, entitled "*Cochlearia officinalis arctica* in the Vicinity of Point Barrow, Alaska" (*1*), may be welcomed as a type of publication of which many more are needed; for commentaries on the habitat preferences, autecology, plant sociological relationships, life form, and other attributes of particular boreal plants can be of interest and value to many—including taxonomists, ecologists, and phytogeographers. Now that arctic opportunities are frequent and such facilities are afforded as those of the Arctic Research Laboratory at Point Barrow, it seems a pity that more critical and even more comprehensive accounts are not forthcoming. Thus, in the paper cited, there is offered no discussion of the taxonomic situation in *Cochlearia* in the region involved—perhaps wisely, in view of its complexity—though one would have expected that in the making of the prerequisite field observations, at least, there would have emerged some ideas about how the plants concerned should be treated taxonomically. Instead, it appears that Hultén's treatment (*2*), which recognizes only one subspecies in the vicinity, has been tacitly accepted; and, whereas there can scarcely be a better authority to follow in such matters, it should be noted that there does indeed seem to be more than one variety of *Cochlearia* in northernmost Alaska. Hultén himself says of the (only) two "races" which he recognizes there and to the south that "There is wide variation within the material and no sharp limit can be drawn between these types, but the tendency in very evident. Whether or not these two types can be further divided on account of other characteristics seems unclear." Thus a direct challenge has been ignored; and, whereas Thomas was perhaps being merely cautious in not taking up one of such proportions, it is to be hoped that others who have the opportunity in the future will tackle such problems. Arctic botany is fairly bristling with them.

I would like to put in a plea, also, for more biological and phenological data on arctic plants whenever they can be obtained. There seems little excuse, considering the ease and comfort of arctic travel and life nowadays, for our continued ignorance about such fundamental matters as dispersal and propagation. An example of what may usefully be accomplished along several of the lines involved is afforded by the two works on *The Structure and Biology of Arctic Flowering Plants*, published by Warming and Ostenfeld and their associates in 1912 and 1921 (*3*), but they deal with only a small proportion of the species inhabiting arctic regions and are mainly concerned with Greenland. Recently the tendency has been for cytological and other introspective lines of investigation to hold sway, and although they have their own fascination and undoubted significance, they should not be allowed to take the place of over-all biological study which, with precise taxonomy, must be included in the main foundations of our edifice of boreal botany. An example of our ignorance in allied connections is the persistent reference to *Koenigia islandica* as the only annual in the Arctic; it is by no means the only one and appears to be by no means always annual—at least according to my observations in the Far North, and particularly in Spitsbergen and the Canadian Arctic Archipelago.

Especially in the case of *Cochlearia* in the Arctic is there an unsolved mystery of the most intriguing nature, on which it might have been hoped Thomas would throw light or at least provide comment—the more so in view of the abundant representation, plasticity, and wide habitat tolerance of the complex in the vicinity. Following his wintering with the *Vega* expedition at Pitlekaj on the Arctic Ocean coast of eastern Siberia, Kjellman (*4*) reported, of an individual of *Cochlearia*, that it

> . . . commenced blossoming in the summer of 1878 but had not concluded its flowering period when the winter descended and put an end to its development. Consequently the floral system contained flower-buds in various stages of development, newly-opened flowers, faded flowers, and more or less ripe fruits. Of the rosette leaves there could be found only small and withered remains, but the upper cauline leaves were fresh and vital. In this condition the plant was overtaken by winter and exposed to its full rigour. One would assume now that this would have destroyed the plant, and that especially the tender flowering parts just developed would have been destroyed by frost and so rendered incapable of further development. But this was not the case. As the summer of 1879

started, the plant continued its development from the point at which it had been interrupted by the start of winter; the flowering-buds opened, and from the axils of the fresh upper cauline leaves developed new inflorescences. The . . . figure shows this remarkable specimen. [Kjellman also remarked that] There are few parts of the world which show such extreme winter climate as the spot on which the *Vega* expedition overwintered. The cold was very long-lasting and went sometimes below −46° C. The specimen in question grew upon the top of a rather high sand-hillock . . . exposed to the lasting and sharp north and north-east wind.[1]

Kjellman, who was an experienced and usually reliable observer, appears to have been chiefly intrigued with the fact that delicate plant parts could survive in spite of the absence of any superficial protection—e.g., by hairs—and a study of his statement and figure seems to leave little room for doubt that he meant precisely what he implied; namely, that "the young flower parts" survived the winter without injury (so far as he could see), and that "external protection is not necessary for vegetative parts of polar plants either."[1] (See also [*5*].) Kjellman does not actually state that the same flowers which opened in one summer could carry on and produce fruits the next year, although this appears to be implied and has since been assumed; indeed, it seems only fair to give him the benefit of the doubt (he was primarily a phycologist) and think, with Dr. Ehrendorfer, that his mention of "young flower parts" might have had reference to those which passed the winter in the bud. Such a phenomenon is approached, if not matched by the performance of many Amentiferae in cool-temperate regions, where the winter temperatures can fall quite as low as in the Arctic, and where the perennating buds are ready to burst forth at practically the first sign of spring. Numerous arctic instances are mentioned in the two volumes of *Meddelelser om Grønland* already cited (*3*).

Kjellman's observation was commented upon by his countryman Simmons, who remarked (*6*) that, in nearly four consecutive years in the Far North, he had never seen such an instance,

> . . . although I paid special attention to such individuals. I think it must have been a rather isolated case which Kjellman has observed, the more so as I have not found it in any other plant either. Flowers and inflorescences that have been surprised by the frost of the beginning of winter, would soon fade when they thawed, even though they appeared to be quite fresh. In some *Saxifraga* species this was often seen.

The same suggestion concerning *Cochlearia* was also commented upon by Braun (*7*), who "is of the opinion that a misrecollection must have taken place," and by the undersigned (*8*), who remarked that "Like Simmons . . . I have not in the area of the present treatise or any other part of the Arctic seen any evidence that plants that come into flower in the autumn can continue flowering and fruiting the next spring in the manner described by Kjellman. . . ." Sørensen, too (*9*), questions the validity of Kjellman's report, remarking that "According to my observations of the species in Greenland, the flowering main axis itself does not survive the winter, whereas lateral axes springing from its base may flower after wintering." Elsewhere (*9*) Sørensen described *Cochlearia* in northeast Greenland as "Least durable . . . most frequently hapaxanthic, having a lifetime of 3–5 years."

As the problem still remained obscure, during a visit to Point Barrow in mid-September 1948, when many plans for attractive future investigations in a wide range of biological fields of endeavor were discussed at the then newly established Arctic Research Laboratory, the writer suggested that this kind of study be followed as a small but worth-while side line, and even marked some plots and plants that might be suitable for watching if the snow that already covered them should remain until the following summer. But owing, presumably, to changes in personnel, little or nothing further appears to have been done; and concerning this complex, Thomas (*1*) merely notes that "*Cochlearia* is probably a biennial plant. The large number of dead plants among the living ones suggests this. Flowering may be delayed until the second year." Here again is need for clarification, in view especially of the last statement quoted in the preceding paragraph.[2]

In at least one case of another cruciferous plant the overwintering controversy may be considered as settled: In his valuable paper already cited (*9*), Sørensen indicates that *Braya humilis* in northeastern Greenland frequently does precisely what Kjellman is supposed to have claimed for *Cochlearia* at Pitlekaj. Thus Sørensen writes (*9*) that "*Braya humilis* occupies a unique position among all the seminiferous species of the area in that inflorescences or infructescences at any stage of development may survive the

[1] Free translation (kindly checked by F. Ehrendorfer) from the authorized German version *Aus dem Leben der Polarpflanzen* in A. E. Nordenskiöld (Ed.), *Studien und Forschungen, veranlasst durch meine Reisen im hohen Norden*. Leipzig, 458 (1885).

[2] By the time the above notes had been drafted, it had become evident that they were more critical than had been intended. The criticisms seemed constructive, however, and so copies of the typed version, instead of being scrapped, were sent to John H. Thomas and to Ira L. Wiggins, the present scientific director of the Arctic Research Laboratory, Point Barrow. The former explained (*in litt.*) that his available time at Point Barrow had been limited, but generously concluded: "I am certain that the advice you put forth in your paper will be of help to those who have the good fortune to botanize in Arctic Alaska in the near future." Dr. Wiggins wrote: "By all means publish the paper on *Cochlearia!* Such things stimulate other workers to better and greater efforts." Dr. Wiggins in another letter written early this year remarked concerning *Cochlearia* that "Last summer I did watch the plants that grew in this area, and I found no evidence that any . . . that had been flowering in the late summer of 1950 had come through the winter in a flowering condition and continued to flower from buds that were almost ready to open in 1950! I very strongly doubt the accuracy of Kjellman, at least in the light of what I've seen here at Point Barrow in three seasons. Even where the plants have lain in swales or along the margins of ravines and therefore well covered with snow during the winter months, the plants from the previous year look pretty sick when the snow disappears and do not grow nearly as well as those that had barely reached the rosette state the previous year. I'll continue the observations this spring, however, and see if any added information can be obtained on this controversial plant."

winter and continue their development in the succeeding growth season;" and, later on:

Within the families *Saxifragaceae, Caryophyllaceas, Cruciferae,* and *Rosaceae* we find the most pronounced power of resistance in floral organs in a fairly advanced phase of development, associated with different degrees of aperiodicity. In accordance with this, the flowers of the early spring are essentially constituted by these families. The only species within these families—and within the flora of Northeast Greenland as a whole—in which floral and fructifying organs in any stage of development have been found to be capable of wintering without suffering any damage, and of continuing and completing the development after wintering, is *Braya humilis.* And it is not only capable of doing so, but the phenomenon occurs so frequently that it may be recorded as normal to the species.

Such plants are probably well covered with snow in winter (*10*). Sørensen suggests that *"Braya Thorild-Wulffii* and *Draba crassifolia* evidently possess a power of wintering in highly developed stages similar to that of *Braya humilis,"* but emphasized again in his "Results and Conclusions" that "The only species in which all the floral and fructificative stages have been found with certainty to continue their development entirely uninjured after the wintering is *Braya humilis."* This species is widespread in Alaska, although apparently it is not known from the vicinity of Point Barrow. It would be interesting to determine whether its behavior is similar in the Territory, and whether other species are able to emulate its feat, even if *Cochlearia* cannot.

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Northernmost Record of the Whale Shark

Rhineodon typus, the greatest of the sharks (av length, 30–40 ft, but reaching to about 60 ft), is a fish native to the three tropical oceans, from which it does not depart except in such outflowing warm currents as the Gulf Stream. In the western Atlantic it is found especially in the Caribbean Sea–West Indies region, in the Gulf of Mexico, among the Florida Keys, in the Straits of Florida, particularly in the region of Havana, and also between Florida and the Bahamas. Until quite recently it had never been noted above the southern tip of Florida, although a dead one came ashore at Ormond, just above Daytona, in 1902. This is the earliest record in Florida waters and, indeed, in the western Atlantic. A specimen was later captured off Miami in 1932, however, and others were noted off the Bahamas some time later (in the Gulf Stream). But, up to 1934, no whale shark had ever been reported from the Atlantic coast of Florida above Miami (25° 46′ N Lat.).

On June 6, 1934, a message was received at the State Museum in Raleigh, N. C., that a whale shark was ashore in Southport Harbor, 4 miles above the mouth of the Cape Fear River, 320 miles farther north than Ormond.[1] H. H. Brimley, of the North Carolina State Museum, set out at once for Southport to obtain the skin if possible, but he reached there only to find that the 50-ft specimen had unfortunately been almost dismembered, so that the skin could not be preserved. This specimen is the first to be put on record on the western Atlantic coast of the U. S. north of southern Florida. The latitude of the locality is about 33° 55′ N. Mr. Brimley put this specimen on record in the *Journal of the Elisha Mitchell Scientific Society* (Aug. 1935). But this record was not due to stand long.

On August 9, 1935, a 31.5-ft Rhineodon blundered into a pound net off Fire Island at Lat. 40° 35′ N and was captured—a second capture north of Florida and 460 miles north of the Cape Fear River occurrence. The full story of this capture and all the records thereof may be found in an article entitled "Rhineodon at New York's Front Door" (Gudger, *Natural History Mag.* [Feb. 1936]).

It was brought into Islip on the southern shore of Long Island, and there I saw it on the floor of a fish-house. It was 31.5 ft long, 4 in. less than 4 ft across the inside of the mouth from angle to angle of jaws, and the spread of the lunate tail was 9 ft. It was truly colossal, the most gigantic thing I had ever seen come out of the sea.

Carried to Fire Island by the Gulf Stream to a parallel of latitude almost touching the southwest corner of New England, it would surely be Rhineodon's "Farthest North" in the western Atlantic. But again this record has been broken.

In the New York *Times* of June 6, 1951, there is a four-paragraph note entitled "Liner *Veendam* Attacked by Whale Shark at Sea"—345 miles off Nantucket Light. But the title is erroneous. The *Veendam,* steaming into a small school of whale sharks, collided with a Rhineodon lumbering across the track of the incoming steamer and broke its back. This great shark was rammed by the steamer in about Lat. 42° 02′ N, Long. 62° 50′ W. This is about the latitude of Cape Cod, Mass., and 380 miles due east thereof, and is 1284 miles (18° 35′ of Lat.) north of the Tropic of Cancer and of the waters between Florida and Cuba. This occurrence is the whale shark's northernmost ob-

[1] Distances are given in statute miles.

served venture, not only in the Atlantic but also in any ocean. It was undoubtedly carried there by the Gulf Stream, and it should be noted that the date is June 5, at the beginning of summer.

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[2] I am grateful to J. M. Fewell, of the U. S. Hydrographic Office, for reading the manuscript of this article and for supplying latitudes and mileages.

Experimental Hypersensitivity

THE mechanism originally proposed by Longcope (*1*) for the course of the experimental hypersensitivity produced by the injection of large quantities of foreign serum proteins into an animal is the following: (*a*) a localization of a portion of these antigenic proteins in the tissues of the animal, (*b*) the formation of antibodies to the protein, and (*c*) the reaction of the antibody with the antigen localized in the tissue.

Hawn and Janeway (*2*), Ehrich, Seifter, and Forman (*3*), and Wissler, Smull, and Lesh (*4*) have reported that lesions were produced in different organs in rabbits, depending upon which protein fraction of the foreign serum was injected. The first two groups of authors suggest that the different lesions are probably a reflection of selective localizations of different proteins in the various tissues of the body. Wissler *et al.*, however, claim on the basis of unpublished experiments to have "shown no evident selective localization of labeled horse serum in the tissues of normal or sensitized rabbits." Latta (*5*), also, was not able to show any such selective localization of radioiodinated bovine serum globulin or human serum albumin; but, as Latta claimed, his experiments were not conclusive because of the high backgrounds of the residual blood radioactivity, which would obliterate any small differential localization in individual organs. Coons, Leduc, and Kaplan (*6*) showed that bovine serum albumin was removed more rapidly from the tissues of a mouse than was human γ globulin, but the relative retention in each organ was the same for the two proteins.

We have carried out experiments (*7*) which do show that the different proteins of a protein mixture (in this case a crude globulin fraction of normal rabbit serum) localize differently in the various organs of the rat. This was demonstrated by iodinating the globulin fraction of normal rabbit serum with iodine containing traces of the radioactive I^{131} and injecting it into rats. Three days later the rats were sacrificed, the organs perfused, and the radioiodinated proteins that remained there eluted at pH 10–11. Upon injection of these recovered proteins into rats, it was found that the material recovered from the liver localized to a greater extent in the liver than in the kidney, and the material recovered from the kidney localized preferentially in the kidney.

The preferential localization of components of the original protein mixture demonstrated in these assays supports the hypothesis of Hawn and Janeway and of Ehrich *et al.* in demonstrating that different serum proteins do localize selectively in different tissues. Just which proteins favor which tissues is not defined by our experiment, and it may be that components present in only low concentration in serum are responsible for the localizations that we observed with the normal serum.

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Zoological Nomenclature

NOTICE is hereby given that, as from January 23, 1953, the International Commission on Zoological Nomenclature will start to vote on the following cases involving the possible use of its plenary powers for the purposes specified in brackets against each entry. Full particulars of these cases were published on July 23, 1952, in the *Bulletin of Zoological Nomenclature*, those relating to cases (1) to (4) in Part 8 and those relating to cases (5) to (10) in Part 9 of Vol. 6. (1) *Ancylus* Müller, 1774 (Cl. Gastropoda) [designation of type species]; (2) *atrox* Baird & Girard, 1853, *Crotalus* (Cl. Reptilia, Order Squamata) [validation]; (3) *polysticta* Cope, 1865, *Caudisona* (Cl. Reptilia, Ord. Squamata) [validation]; (4) *Palaeopsylla* Wagner, 1903 (Cl. Insecta, Ord. Siphonaptera) [designation of type species]; (5) *Heterandria* Agassiz, 1853 (Cl. Osteichthyes) [designation of type species]; (6) *Lobocantha* Kirby, 1837 (Cl. Insecta, Ord. Coleoptera) [suppression, to validate *Platypria* Guerin, 1840]; (7) *tereticauda* Eschscholtz, 1833, *Triton* (Cl. Amphibia) [suppression, to validate *lugubris* Hallowell, 1849, *Salamandra*]; (8) *Euryrhynchus* Miers, 1877 (Cl. Crustacea, Ord. Decapoda) [validation]; (9) *Pontonia* Latreille, 1829 (Cl. Crustacea, Ord. Decapoda) [designation of type species]; (10) Martyn, 1784, *Universal Conchologist* (Ph. Mollusca) [validation of following trivial names published in *arabicum, canaliculus, crenata, denticulata, granosus, haustrum, heliotropum, iris, linea, maculosum, opalus, papulosum, punctulatus, purpurata, smaragdus, sulcatus, tigris, vermis.*] Comments on the above cases should be sent as soon as possible to the secretary.

FRANCIS HEMMING, *Secretary*
International Commission on Zoological Nomenclature
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Book Reviews

The Terpenes: The Sesquiterpenes, Diterpenes and their Derivatives, Vol. III. 2nd ed. Sir John Simonsen and D. H. R. Barton. New York: Cambridge Univ. Press, 1952. 579 pp. $10.00.

The increasing importance of the chemistry of the higher terpenes is shown by the necessity for this book. In 1932, the second volume of the first edition of this monograph devoted only 114 pages to the sesquiterpenes—much of this space being taken up by substances of unknown constitution and uncertain identity. In the present volume, covering the literature through 1949 and modestly termed a second edition, the sesquiterpenes are given nearly three times as many pages; a wholly new section on the diterpenes has been added. This field of research is not closed, however, and it is to be hoped that the next 20 years will see the chemistry of the sesquiterpenes placed on as firm a basis as that upon which the chemistry of the monoterpenes rests. A sign that this is occurring is found in the fact that some portions of this work, notably those dealing with humulene and β-caryophyllene, are already obsolete.

Those familiar with Volumes I and II of the present edition need not be told that this volume is concisely and clearly written, and thorough but critical in its coverage of the literature. Such readers will be pleased to note that it contains addenda to the previous volumes (80 pp.) covering the literature on the monoterpenes from 1947 to 1950 (prepared by the senior author and L. N. Owen).

This work is, generally speaking, well organized. Subsections of subchapters are devoted to individual compounds. The main sources, methods of isolation, and the physical properties of each substance are very briefly summarized. Evidence as to the structure of the compound is then presented in detail, with an abundance of structural formulas, followed by a textual summary of the principal derivatives and reactions of the substance. Although the work is obviously not intended to be a handbook, it seems possible that some improvement might be achieved by the use of tabular summaries of the physical properties and derivatives arranged to permit easy comparisons among substances of similar properties.

The authors are particularly to be commended for their critical judgment in the assignment of structural formulas to the compounds. In this respect they show more caution than many of the workers quoted, and one may feel considerable confidence in most of those structures that are indicated as established. It should be remembered, however, that few of these substances have been synthesized by unequivocal methods and that many of the structural assignments rest heavily on the results of dehydrogenation at high temperature. The caution of the authors has not prevented them from using the best formulas available in 1950 to illustrate the oftentimes intricate chemistry of degradation reactions. These formulas are usually clearly identified as tentative and serve as valuable summaries of the work so far done; the clarification achieved by this somewhat less than rigorous approach would seem to be well worth while.

One of the great values of the study of the chemistry of natural products is the respect it breeds for the ability of organic compounds to undergo rearrangement and isomerization. This point is brought out throughout this work, but particularly well in the special article on santonin, by W. Cocker. This chapter is especially recommended to organic chemists in general as an object lesson in stereochemistry, molecular rearrangements, and the dangers of jumping to conclusions on the basis of too much respect for "general reactions." It is also recommended as an outstanding example of the order that can be brought from chaos by clear but highly condensed chemical writing.

This book, with its companion volumes, should be in every institutional library and in the libraries of chemists working with flavoring matters, essential oils, or the resin acids. It seems likely that other chemists, especially those with interests in polycyclic compounds, pharmaceuticals, stereochemistry, or mechanisms of rearrangement will find enough of value here to justify its purchase. The binding, paper, and typography are good. There must be several thousand structural formulas in this book; a few of these contain typographical errors minor enough to cause only temporary confusion.

It is to be hoped that the authors, one of whom is making important contributions to the chemistry of the triterpenes, will find it possible in the near future to extend the scope of this monograph to include that field as well.

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Prehistoric Europe: The Economic Basis. J. G. D. Clark. New York: Philosophical Library, 1952. 349 pp. Illus. $12.00.

Grahame Clark, recently elevated to the Disney professorship of archaeology at Cambridge, has produced his fifth major volume on European archaeology. This large and handsome book, beautifully printed by John Bellows of Gloucester, England, is copiously and instructively illustrated. In it Dr. Clark has, in a nutshell, restored the organic element to European archaeology, concentrating on perishables, particularly wood, bone, horn, bark, bast, leather, matting, basketry, and textiles. Drawing his materials from swamps, bogs, and preliterate art representations on stone, he has compared them with European folk survivals. The result is a coherent and well-rounded picture of the economic life of that subcontinent, particularly its northwestern portion, from the end of the last glaciation to the beginnings of recorded history.

It is furthermore a relief from the atmosphere of most works on the same subject in which attention is largely devoted to flint typology. This shift of emphasis and broadening of sources of evidence are needed now that we are beginning to find out that the classic sequences of flint typology set up by the French school and slavishly followed elsewhere may have overemphasized the importance of selected minor variations of tool styles. Some of these, being largely local, may turn out to make little difference in the end product, as seen in the perishables that Clark has so carefully sought out and restored or reconstructed. Although he has covered but a fraction of the time span so assidulously explored by the French school, the principles derived from his work may add a new breath of life to the results of their painstaking industry.

Clark has made full use of statistical techniques, slighted by many of his colleagues. This is particularly necessary in dealing with the bones of wild and domestic animals in Neolithic and early Metal Age collections. That he has not mentioned radiocarbon dating is not surprising, since the latest date in his bibliography of over 750 titles is 1949. However, his profound acquaintance with the minutely detailed climatic studies of the Dutch and Scandinavians makes this relatively unimportant, within the time and space spans covered. The reviewer's only regret is that the subject had to be limited by the nature of the materials largely to northwestern Europe. It opens a clear and brightly polished window on one corner of the world. If only we could see Turkestan and China in the same brilliant light!

The price, which may deter many potential readers, is not excessive when one sees the beautiful printing, and the wealth of illustrations, which will be used as slides in many colleges for years to come. Costing no more than two and a half bottles of Scotch whiskey, this competing British import can provide stimulation over a much longer period.

CARLETON S. COON
University of Pennsylvania Museum

Symmetry. Hermann Weyl. Princeton, N. J.: Princeton Univ. Press, 1952. 168 pp. $3.75.

This short book on a vast subject is the work of a master. With a few sure and authoritative words he gives us the heart of the matter. There is no book or article quite like this one on the subject of symmetry, and I doubt if any book will be written in the future that will not in some way lean upon this one.

It starts off with the easy and specific matter of bilateral symmetry and shows how right and left reflections have been used in art, and how in biology it is a matter of import to many organisms, including man. There is a pleasant mixture in this chapter, ranging from the embryological origin of left and right in the worm *Ascaris* to the symbolic meanings the left (or sinister) has taken in times past. Next comes an analysis of translatory and rotational symmetry, leading to a chapter on ornamental symmetry. The same pattern is kept, a mixture of art and natural science, and it takes us from the walls of a room in the Alhambra in Granada to the comb of a bee, from the baptistry at Pisa to the Radiolaria of Haeckel. The last of the four chapters goes into the basis of crystal symmetry, symmetry in relativity, in quantum mechanics, and in mathematics.

The book begins with a general description of what is meant by symmetry, and then proceeds through the specific kinds of symmetry to a general mathematical statement of symmetry. This means that as the book progresses it does become more abstract and more difficult for the nonmathematician to follow. But fortunately it contains so much besides mathematics (although the latter is the main point) that it can still be read with profit and enjoyed by someone who has not advanced beyond long division. More than anything else the book gives the feeling of authority—which its substance, as well as all the other things we know about Professor Weyl, substantiates.

This is the work of a mathematician, and there is one aspect of the book that may disturb the natural scientist as it will the art historian. The biologist is interested in the cause and the mechanism or origin of certain symmetries. For instance, Weyl discusses the phyllotaxis of plants, the arrangements of leaves in whorls, but does not touch upon the recent work on the cause of these leaf distributions. Or, in art history, he shows that certain symmetrical patterns are used by the Greeks, or the Minoans, or the Sumerians, but he does not tell, except in an occasional passing reference, where these patterns had their origin and how they can be traced in the history of art. This is not an omission on the part of the author—his book is on the subject of symmetry itself, what symmetry is, and how it may be precisely defined and described. It is the approach that would have satisfied Plato, and in fact Weyl himself says in the beginning of the book that his argument will go "along a road that will finally lead us to a mathematical idea of great generality, the Platonic idea, as it were, behind all the special appearances and applications of symmetry."

JOHN TYLER BONNER
Department of Biology, Princeton University

The Auricular Arrhythmias. Myron Prinzmetal, Eliot Corday, Isidor C. Brill, Robert W. Oblath, H. E. Kruger, *et al.* Springfield, Ill.: Thomas, 1952. 387 pp. Illus. $16.50.

This monograph describes the authors' researches concerning the auricular arrhythmias. It also presents historical reviews and clinical discussions of these arrhythmias. The methods of study and the equipment used are described in an appendix. Their observations have been made with the high-speed cinematograph, the multiple-channel electrocardiograph, and the dual-beam cathode-ray oscillograph.

The authors begin their book with a study of the

normal auricles. They conclude that contraction does begin in the region of the sino-auricular node about midway between the cephalic and caudal ends, that there are no special inter- or intra-auricular conduction pathways, and that the inter-auricular septum is an integral part of the auricles. They offer evidence to confirm the view that the contraction wave spreads in a fashion that reaches points equidistant from the site of origin at the same time and that it dies out when it can travel no further.

Experiments are then described from which they conclude that extrasystoles and paroxysmal tachycardia arise from a single ectopic focus, and that the contraction wave spreads in the same fashion as it does in normal sinus rhythm. The same arrhythmias are studied in man, and the authors decide that they do not differ from the experimentally induced arrhythmias in dogs. The argument is then carried to auricular flutter and fibrillation, and from their experimental evidence and studies in man they conclude that these arrhythmias also arise from a single ectopic focus and that a "circus movement" is not present.

The pharmacology of quinidine and digitalis and the treatment of the various auricular arrhythmias are discussed. The final chapter brings together the authors' evidence as to the unitary nature of the auricular arrhythmias.

The book is well put together, and the illustrations are both profuse and excellent. It presents an important conception of the nature of the auricular arrhythmias, and the evidence adduced in its favor is indeed weighty. Cardiologists should be familiar with the authors' views from previous publications. This book brings them together in a single volume which is worth while to physicians in general because of its clinical features, and because of the clarity and logical development of the views presented. The evidence presented certainly reopens the question as to the existence of circus movements in auricular flutter and fibrillation. At the moment, the book would have lost nothing had the discussion of the Wolff-Parkinson-White syndrome been omitted.

WILLIAM S. LOVE
1214 N. Calvert Street, Baltimore, Maryland

The Ocean River: The Story of the Gulf Stream. Henry Chapin and F. G. Walton Smith. New York: Scribner's, 1952. 325 pp. Illus. $3.50.

It has been difficult for this reviewer to keep clearly in mind just what authors Chapin and Smith mean by the Ocean River. At times they appear to mean what oceanographers call the Gulf Stream system—that narrow, intense ocean current extending from the Straits of Florida into the North Atlantic east of the Grand Banks. At other times the entire North Atlantic Ocean is included, and the reader unexpectedly finds himself in the Caribbean or the North Sea. Indeed, there is a great deal of rambling in this book, and unfortunately most of it is only incidental to the Gulf Stream.

The first three chapters are a sketchy summary of historical geology. The entire fourth chapter is an account of the myth of Atlantis, partly drawn from the writings of Ignatius Donnelly, a pre-Velikovsky congressman from Minnesota, who, suffering from intellectual indigestion in the Library of Congress, wrote voluminously on other startling subjects, such as the Baconian controversy. All this, of course, has nothing to do with the Gulf Stream.

Chapters five and six bring us from the Phoenicians, through Leif Ericson, to the Franklin chart of 1770.

It is only in the last half of chapter seven that the reader will find several pages (140–47) that give any account of the results of the past 20 years of scientific work on the physical oceanography of the Gulf Stream. The scientific reader will be disappointed to find that there are no figures showing the thermal structure across the stream, that there are no velocity profiles, that there is no discussion of the water masses involved. It is this exceptionally scanty and superficial treatment of the modern knowledge of the structure of the Gulf Stream that detracts so much from the value of the book to a scientific reader. There are many exciting and intensely interesting problems concerning the Gulf Stream being uncovered today. For example, we are just beginning to make measurements of velocity as a function of depth in the parts of the stream in deep water; we are just now beginning to formulate dynamical laws for the current and its meanders; and we are in the progress of developing new strategies of exploration. But none of these things finds a place in *The Ocean River*.

Chapter eight deals with winds; chapter nine with fishes. The remaining five chapters are concerned with Spanish conquistadors, pirates, New England merchant trade, the Banks cod fisheries, etc., ending with a sociological essay on the Atlantic and Western man.

It is the unreserved opinion of this reviewer that *The Ocean River* is too diffusely written to be of any interest to the scientific reader. It is a pity that someone does not translate into English a really good book on the Atlantic Ocean: Gerhard Schott's *Geographie des Atlantischen Ozeans*.

HENRY M. STOMMEL
Woods Hole Oceanographic Institution

Scientific Book Register

Food Science: A Symposium on Quality & Preservation of Foods. E. C. Bate-Smith and T. N. Morris, Eds. New York: Cambridge Univ. Press, 1952. 319 pp. Illus. $8.00.

Synthetic Methods of Organic Chemistry: An Annual Survey, Vol. 6. W. Theilheimer. Basel: S. Karger, 1952; U. S. distrib., Interscience, New York. 401 pp. $12.90.

The Origin and History of the British Fauna. Bryan P. Beirne. London: Methuen, 1952. 164 pp. Illus. 18s.

Functional Endocrinology from Birth through Adolescence. Nathan B. Talbot *et al.* Cambridge, Mass.: Harvard Univ. Press, 1952. (Published for the Commonwealth Fund.) 638 pp. $10.00.

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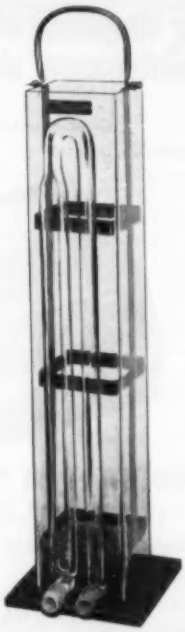

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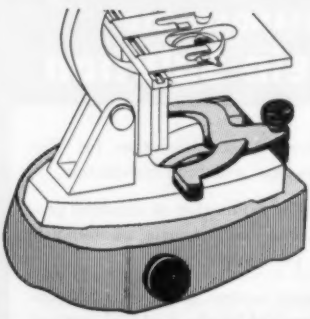

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of the General Program-Directory of the St. Louis Meeting of the AAAS

By first class mail – early in December

The General Program-Directory of the 119th Meeting of the AAAS in St. Louis, December 26–31, 1952, will be available to anyone, at cost, within the first week in December—whether he can attend the Meeting or not. This year the General Program will be much simplified in format and the Directory content increased. You will want it for your reference shelf.

Program content

1. The General Symposia: "Disaster Recovery" and "The Nation's Nutrition."
2. Programs of the 18 AAAS sections and subsections (symposia and contributed papers).
3. Programs of the more than 30 participating societies.
4. The Special Sessions: AAAS, Academy Conference, Conference on Scientific Manpower II, National Geographic Society, Phi Beta Kappa, RESA, Sigma Xi.
5. Details of the Kiel Auditorium, downtown hotels, Washington University.
6. Titles of the latest scientific films to be shown in the AAAS Science Theatre.
7. Exhibitors in the 1952 Annual Exposition of Science and Industry and descriptions of their exhibits.

Directory content

1. AAAS officers and staff for 1952.
2. Complete roll of AAAS presidents and their fields.
3. The 236 affiliated organizations.
4. Historical sketch and organization of the Association.
5. Publications of the Association.
6. AAAS Awards and Grants—including all past winners.
7. Membership figures by sections.
8. Section committees (Council members) in detail.
9. Local committees.
10. Future Meetings of the AAAS.

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